ELECTRICAL REVIEW

[ILLUSTRATED.]

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Instruments of Electrical Measurement.

The engravings on pages 1 and 3, represent the general construction of the ammeters, volt-meters and the volt-am-meters, made under A. K. Eaton's patent of January 22, 1884.

Fig. 1 is a volt-am-meter, of the simplest and least expensive form. The principle of its construction and the mode of using are as follows: The dark ring outside of the graduated circle is an annular steel magnet having its north and south poles at opposite points of the circle. The needle is also a thin annular magnet supported in the usual way, with aluminum pointers extending to the graduated circle. The poles of the annular needle are always held in line with the poles of the outer magnetic or field ring, and the effect of terrestrial magnetism is thus practically eliminated. The annular field magnet is adjustable, so that the needle and the pointers upon the movable ring may be made to correspond to the zero of the circle. If it is desired to determine the strength of a current in amperes, the leading wires a re connected with the posts marked "Amp." The current then passes simply through a flat bar of copper beneath the needle. The needle is deflected to a greater or less degree, but is immediately brought back to zero by rotating the annular field magnet. The amount of movement required to do this—which is indicated by a pointer attached to the ring—represents the strength of the current in amperes. The small instrument is generally calibrated, so that 1° shall represent 1 ampere, in which case the full range would be 45 amperes, accurate measurements being limited to a movement of the ring of 45° in either direction from zero. When the instrument is to be used to determine electromotive force the leading wires are connected with the posts marked "Volt," in which case the current passes through a coil of high resistance beneath the needle. The deflection is reduced to zero, as before, by the rotation of the field ring, and this electromotive force, in volts, read by means of the ring pointers. The instrument is generally calibrated, so that each degree represents 1 volt, giving an extreme range of 45 volts; the rate of reading, however, so that 2 degrees will represent 1 volt or ampere, in which case the range would only be 22½. These instruments may be standardized at different rates of reading to suit any special requirements.

The large volt-am-meter represented in Fig. 2, is constructed on the same principle as the one just described, but is capable of being adjusted at will to any required rate of reading, and to the measurement of currents of very high or very low tensions or current strength. For instance, its range may be varied so that it will measure in one position from one-tenth of a volt to 45 volts, and in another from 1 volt to 450. This is effected by a vertical movement of the head of the instrument, which may be raised more or less by turning the milled head on the side of the instrument. The needle, graduated circle and annular magnet outside of the circle, are thus carried away from the actuating coil in the body of the instrument, and the range thereby increased to meet the requirements of the case. A vertical graduated scale enables the operator to set the instrument for any desired range. A table is supplied with each instrument, showing the different positions corresponding to different ranges. The connecting plug represented on the left of the engraving is changed from one hole to the other, according to the requirements of the work. In the position represented the instrument would give amperes of current. If changed to the other hole electromotive force in volts will be indicated. On the right side of the engraving a reversing switch is represented by means of which, opposite readings may be taken.

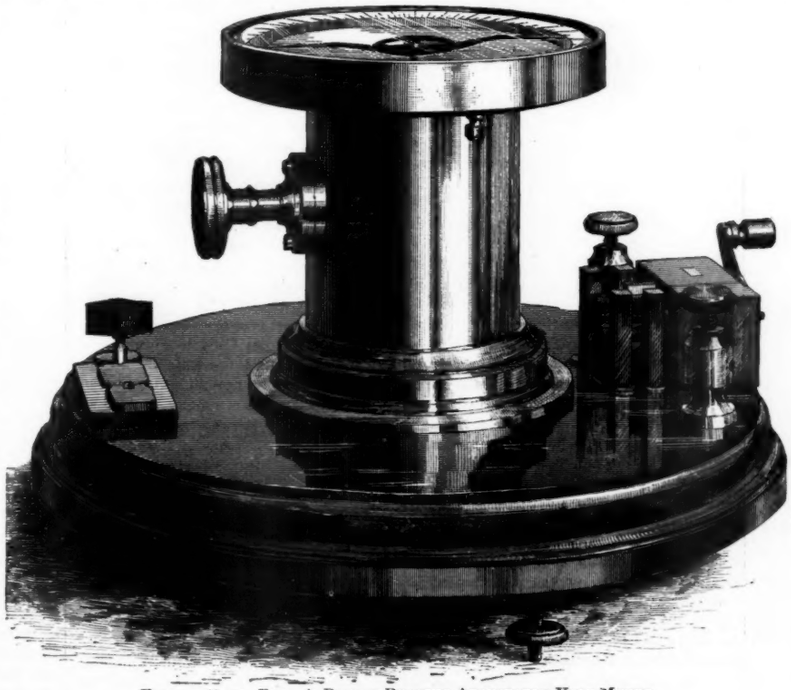

Fig. 2.—Prof. Eaton's Direct Reading Adjustable Volt-Meter.

All of Prof. Eaton's instruments are noted for their reliability and accuracy. Should any of our readers desire to communicate with him, his address is 65 Henry Street, Brooklyn.

* * *L'Illustration* states that a manufacturer at Breslau has built a chimney 16 meters high (51 feet 6 inches) entirely of paper. The blocks used in its construction, instead of being of brick or stone, were made of layers of compressed paper, jointed with some silicious cement. The chimney is very elastic, and at the same time is fire-proof, and is less liable than ordinary chimneys to be struck by lightning.

Electric Locomotion.

By A. Reckenzaun.

II.

There is not the slightest necessity for us to endeavor to disprove the assertion, made twenty-eight years ago, that "electric power depends on zinc;" everyone knows that steam engines, gas engines, or water-wheels are now the principle agents in the production of powerful electric currents; the mechanical energy of these prime movers is readily converted into electrical energy by simply moving copper wires or other conductors between the poles of powerful magnets. The space between and around the magnet poles is termed the magnetic field, and it is assumed that the magnetism travels through iron or steel in lines, which are called magnetic lines of force. The stronger the magnet is, the denser are these lines of force; and there is a practical limit to the number of lines of force which a piece of iron of a given sectional area can carry at an economical rate of exciting power. If we move a straight piece of copper wire (the ends of which we join to a galvanometer) at a given velocity within the magnetic field, cutting the lines of force at right angles, we find that a current of electricity is set up in the copper wire; two such wires placed side by side, but with their ends connected, when moved in the same magnetic field at the same velocity will produce the same current with double the electromotive force; thus we may fill up the circumference of a drum or cylinder with wires parallel to one another and to the axis of rotation, and thereby obtain an electromotive force proportional to the number of wires cutting the magnetic lines. It will take twice the power to move two similar wires within this uniform field that it does to move one, and twenty times the power to move twenty wires with a given velocity. By rotating these (wires which may be held by a cylinder) twice as fast in the same magnetic field, we get double the electromotive force, and again exert double the power in causing rotation of the cylinder, or, as it is commonly called, the armature of a dynamo-electric machine. These are the most elementary principles involved in the mechanical production of electric energy. There were at the International Inventions Exhibition a number of dynamo-electric machines which were so well constructed that it would appear almost impossible to suggest further improvements; these machines did not only work without requiring any more attention than, for instance, a substantially made water pump, whilst they converted over 80 per cent. of the mechanical power which drove the spindles into electrical energy, but it appeared, from the inappreciable amount of wear, that they cannot easily be worn out. It will be interesting to know the actual depreciation in dynamo machines as recently manufactured by the most eminent makers, such as Siemens, Crompton, Mather and Platt, Kapp, the Brush Company, Paterson and Cooper, and a few others; we are inclined to estimate this item at 7 per cent. on the selling price. These successful firms have each a particular type or design of dynamo, and they all know that with a certain quantity of iron and copper they are able to obtain a definite effect at a given efficiency; we may, therefore, safely say that dynamo-electric energy, as at present understood, depends on mechanical power causing conductors to move in a magnetic field. We have nothing to do with the construction of dynamo-machines; our aim is to utilize the electric energy delivered at the terminals, and utilize it to the best advantage. We propose to transmit the current from the dynamo (generator) to another dynamo (motor), and by means of the latter convert electric energy into mechanical power. All continuous current dynamos are reversible; that is to say, by sending a current through the field-magnet coils and the armature coils, the magnetic poles set up in the iron cores attract and repel each other, as the case may be, and thereby produce motion or continuous rotation. Now this very act of rotation, the moving of the armature coils in a magnetic field, causes a reaction, a counter current, or, as generally termed, a counter electromotive force is set up in the armature, which appears to impede the flow of electricity from the generator to the motor. This counter electromotive force is greatest when the armature rotates fastest, that is, when the motor is allowed to do little work; but then the current consumed is extremely small. If

we exert a sufficient force upon the armature spindle so as to prevent rotation entirely, then the current circulating through the motor circuit will be large, because no counter electromotive force is generated, and the whole of the current is converted into heat instead of work. Thus, according to Ohm's law, the current flowing when the armature is prevented from revolving will be

$$C = \frac{E}{R}$$

Where E represents the electromotive force at the terminals of the machine, and R the resistance of the machine. As soon as we allow the armature to revolve a counter E.M.F., e, is generated, when the current will be reduced to

$$c = \frac{E - e}{R}$$

or, knowing C and c by direct measurement we can calculate

$$e = \frac{C - c}{C} E;$$

the electrical work put into the machine is $W = E\ c$, the *useful* electrical work which the motor takes up is $w = e\ c$, therefore the electrical efficiency must be

$$f = \frac{w}{W} = \frac{e}{E} = \frac{C - c}{C}$$

By Joule's law we know that heat waste caused by the current circulating through a known resistance R is

$$J = c^2\ R.$$

This heat waste being the only loss which we are at present taking into account, we have

$$W = w + J$$

therefore by substituting the above values we get

$$W = w + c^2\ R$$

and

$$w = W - c^2\ R,$$

and if we substitute

$$\frac{E - e}{R}$$

for c we obtain

$$w = \frac{(E - e)\ \left\{ E - (E - e) \right\}}{R}$$

$$= e\ \frac{E - e}{R}$$

These simple expressions, it must be remembered, refer to the motor only, and no account is taken of such losses as friction, Foucault currents, and churning air, which factors depend upon the mechanical construction, and which will be considered separately.

We propose to set at once to work and test a motor which is ready at hand; we have an unlimited supply of current from a dynamo or any other convenient source. We shall run this motor at various speeds, using various E.M Fs. and currents, and thereby obtain all sorts of powers and efficiencies. Now in order to obtain reliable results, we must have reliable instruments wherewith the energy absorbed can be readily measured, viz., amperemeters and voltmeters; the mechanical power got out of the motor, we measure by an absorption dynamometer and a speed counter. Since we have the choice of several kinds of dynamometers or brakes, we may devote a little time to the study of the construction and use of a few of these indispensable apparatus; for the value of the results depends not only upon the care taken in making observations, but largely upon the condition our instruments may be in at the time.—*Telegraphic Journal and Electrical Review.*

New Patent Office Rules.

The amendments to the rules of practice before the patent office have been completed by the Assistant Secretary of the Interior and the Commissioner of Patents. The most radical changes, and those whose effect will materially change the method of filing claims and applications, are as follows:

35. The specification must set forth the precise invention for which a patent is solicited, explaining the principle thereof and the best mode in which the applicant has contemplated applying that principle, so as to distinguish it from other inventions.

36. In case of a mere improvement, the specification must particularly point out the parts to which it relates, and must, by explicit language, distingush between what is old and what is claimed as new, and the description and the drawings, as well as the claims, should be confined to the specific improvement, and such parts as necessarily co-operate with it.

37. The specification must conclude with a specific and distinct claim or claims of the part, improvement, or combination which the applicant regards as his invention or discovery.

38. Where there are drawings, the description will refer to the different views by figures, and to the different parts by letters or figures (preferably the latter).

39. The following order of arrangement should be observed in framing the specification:

1st. Preamble, stating the name and residence of the applicant and the title of the invention, and, if the invention has been patented in any country, the country or countries in which it has been so patented, and the date and number of each patent.

2d. General statement of the object and nature of the invention.

3d. Brief description of the several views of the drawings (if the invention admits such illustration).

4th. Detailed description.

5th. Claim or claims.

6th. Signature of inventor.

7th. Signatures of two witnesses.

86. Applicants for reissue, in addition to the requirements of rule 45, must also file with their petitions a statement on oath as follows:

1st. That the applicant verily believes the original patent to be inoperative or invalid, and the reason why.

2d. Where it is claimed that such patent is so inoperative or invalid "by reason of a defective or insufficient specification," particularly specifying such defects, or insufficiencies.

3d. Where it is claim that such patent is inoperative or invalid "by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new," distinctly stating such part or parts so alleged to have been so improperly claimed as new.

4th. Particularly specifying the errors which it is claimed constitute the inadvertence, accident, or mistake relied upon, and how they arose or occurred.

5th. That said errors arose "without any fraudulent or deceptive intention" on the part of the applicant.

140. Upon receiving a petition which shall state concisely and clearly any proper question, which has been twice acted upon by the examiner, and which does not involve the merits of the case, or the rejection of a claim, and which shall also state the facts involved and the point or points to be reviewed, an order will be made fixing a time for hearing such petition by the commissioner, and directing the examiner to report upon or answer the matters averred in such petition at least five days before such day of hearing.

944. Immediately upon taking an appeal the appellant must give notice thereof to the commissioner of patents, and file in the patent office his reasons of appeal specifically set forth in writting.

145. *Pro forma* proceedings will not hereafter be had in the patent office for the purpose of securing to applicants an appeal to the supreme court of the District of Columbia.

—— The Consolidated Electric Light Co., (Sawyer-Mann patents), under the able management of P. H. Alexander, at Boston, is pushing things in the electric-light field. In addition to the isolated plant for the New England Telephone and Telegraph Co., mentioned in our last issue, Mr. Alexander has just closed a contract with Messrs. Wm. S. Butler & Co., of Boston, for an isolated plant of 18 arc and 150 incandescent lamps to be placed in their large dry-goods establishment on Tremont street, Boston.

What is Going on in Electric Light Circles in Louisville and Cincinnati.

(From a Correspondent of the REVIEW.)

At Louisville, Ky., I called on the Louisville Electric Light Company. They are using the U. S. system. I found Mr. J. E. Lockwood, the manager, a very pleasant gentleman. He told me they were running 140 arc and 300 incandescent lamp', using a 125 horse-power Reynolds-Corliss engine. Their dynamo has a capacity for 200 arcs. They are lighting the new Grand Theater in that city, using 175 incandescent lamps. The Brush Company, of Louisville, have lately moved into new quarters. They have been "toning up," as it were, putting new armatures to their dynamos, placing new lamps, wires, etc., and have a new superintendent, Mr. S. C. Dodge, who was formerly manager of the Louisville Electric Time Company, (and, by the way, the time company is getting along finely. Mr. H. Zoller having succeeded to the management). Mr. Dodge expected to be in running order by December 1.

From Louisville to Cincinnati I traveled by boat, and found quite a little plant on board, —the Fritz engine and the Van Depoele dynamo. Most of the river steamers in this locality use the same. At Cincinnati I saw Mr. George Hauss. He calculates, barring accident, to be ready for operation early in December. He has quite a little plant in Heuck's Theater. He has three dynamos, one with a capacity of 400 incandescent, one of 150 incandescent and one of 20 arcs. He has the theater well filled, and his key board is a fine piece of mechanism. He has 40 lights in the footlights and 300 in the building. Probably the largest isolated plant in the city is the one on trial in the Central Union Depot. There are two 700-light dynamos, and two Buckeye engines. There are 1,200 16 candle-power lights in the building, and just outside the main entrance is a 200 candle-power incandescent lamp. In conversation with Mr. Ryland, of the Brush, he told me the gas company was testing a chemical which, when the gas passed through it, decomposed and burned it, so as to produce a steady white light which closely resembled the electric light. L. T.

CINCINNATI, O., Nov. 30.

How Old Sol Used to Shine.

In 1303 and 1304 the Rhine, Loire and Seine ran dry. The heat in several French provinces during the summer of 1705 was equal to that of a glass furnace. Meat could be cooked by merely exposing it to the sun. Not a soul dare venture out between noon and 4 P. M.

In 1718 many shops had to close; the theaters never opened their doors for three months. Not a drop of water fell during six months.

In 1773 the thermometer rose to 118 degrees.

In 1778 the heat at Bologna was so great that a great number of people were stifled. There was not sufficient air for the breath, and people had to take refuge under the ground.

In July, 1793, the heat again became intolerable. Vegetables were burned up and fruit dried upon the trees. The furniture and woodwork in dwelling-houses cracked and split up; meat went bad in an hour.

—— The Wheaton Sub Electric Conduit Company has been incorporated in this city, with a capital of $1,500,000 for the purpose of laying wires underground. The corporators are John A. Belvin, Samuel Conover, Charles A. Post, John J. Kiernan, John A. Todd, Stephen T. Willett and Henry A. Heiser.

—— Mr. John C. Yawkey, who has been so long with the Swift Electric Light Co., at East Saginaw, is at present located in Minneapolis in the interest of his uncle, disposing of northwestern pine lands. Before leaving he was given a banquet by the East Saginaw boys, and presented with a nicely-engraved gold-headed cane. "Jack" was a great favorite in East Saginaw circles, and it is said there are few Minneapolis young ladies who can flutter around in the bright light of his society without singeing their wings.

* * The Braddock Wire Company, of Braddock, Pa., has been incorporated with a capital stock of $100,000, and is preparing to erect works at Rankin Station, near Braddock. The principal stockholders are St. Louis parties, with Lieutenant Thomas W. Fitch, son in-law of Gen. Sherman, as president and general manager.

* * During October, the Arizona Copper Prince Company smelted 2,490,571 pounds of ore with 403,825 pounds of San Pedro coke, in 7,844 charges, 688 hours, and produced 404,133 pounds of black copper, about 96 per cent. copper. The copper in the ore varied from 16 to 23 per cent., and in the slag averages 1¾ per cent. We are informed that the Prince will be closed, the low price of copper making it more desirable to keep it in the mine than to send it to the market.

* * Many of the old railroads in the South in existence in 1880 have been purchased since by syndicates and vastly improved and extended, so as to develop new territory and make new connections. Besides this, however, many millions of dollars have been expended in building new roads, and a wonderful impetus has been given to the development of the resources of the South. The increase in mileage alone in five years has been 9,323 miles. The smallest increase of any State has been in Maryland—forty-two miles—and South Carolina comes next in smallness with 136 miles. Virginia shows an increase of 794 miles, which is exceeded by only two States—Texas and Arkansas.

* * To many, the coating of a dome or roof with thin gold-leaf would seem to be a waste of material; the first snow or hail storm would pierce or tear it to shreds. The fact that the gold defies the wear of the weather induces the belief that it is much thicker than the leaf used by sign-painters, bookbinders, and makers of fancy ornamental articles; but the fact is, that the gold-leaf is precisely the same, airy, fleecy, and capable of floating in the air like a gossamer fiber. The gilder of the dome of the capitol at Hartford, Conn., Capt. Thomas F. Burke, said that his principal trouble in doing the work was from currents of air, the altitude being more than 200 feet from the ground, and the site of the building itself being one of the highest in the city. To do the work properly, he constructed a movable canvas shield made to fit the curvature of the dome and its 12 radial ribs, not so much to shield the workmen, as to prevent the leaf from being blown away. To cover this dome—an area of 4,100 square feet—there were used 87,500 leaves of gold, each 3¾ inches square, weighing in the whole three pounds avoirdupois. The total cost of the gold and the labor was $1,600.

* * A few score o persons, expecting to find the new electric car running on Ridge Avenue, Philadelphia, faced the threatening storm one day last week, and hung idly along the avenue to witness the expected trial; but they were not rewarded for their trouble, and it will be several days yet before the car will be in working order. The test in the workshop on Friday was only partially satisfactory in its result, but it warranted the gentlemen in placing the car on the track and giving it a quiet trial on Saturday evening. No guests were invited, and there were but few spectators. The car was run two or three times up and down the track in the space of a square, when suddenly part of the apparatus broke, and the current was stopped. Of course the car stopped, too, and then it was drawn back into the shop. All the next day men were at work on the car, and several changes and improvements will be made. The electricians claim that they are working under many serious disadvantages. The dynamo is driven by a very poor and unreliable engine, which is used to cut feed in the depot, and they cannot place any dependence on the speed. The conduits have been laid but a few squares along the track, but if the car works satisfactorily the conduits will be extended further, and the system will be subjected to a very severe est in climbing a steep hill.

A Successful Electric Light Company.

INTERESTING HISTORY OF THE ONWARD MARCH OF THE MINNEAPOLIS BRUSH ELECTRIC COMPANY.

One of the finest and most successful electric-light plants in the United States is that of the Minnesota Brush Electric Company at Minneapolis, Minn. The company is composed of leading business men and capitalists, and has the exclusive control, in Minnesota, of the Brush and Swan systems, and the business has been pushed with great tact and energy. Minneapolis is blessed with a gas company having an exclusive franchise, so far as gas is concerned, running thirty or forty years; and one of the two men who owned all the stock of the gas company was mayor of the city when the Brush Company obtained from the city council a franchise for setting its poles on the streets. This ordinance the gas mayor promptly vetoed, on the ground of 'danger" from the electric light wires. A few months later another mayor was elected, and the Brush Company's ordinance was signed. They at once put in a plant of 120-light capacity, and within sixty days the price of gas tumbled from $3.50 to $2.50 per M. The Brush Company then erected an iron mast on a public square, similar to the masts at Cleveland, and 257 feet in height, surmounted by eight 4,000 candle-power lamps, and ran the light gratuitously for three months. The city then adopted the mast light and a few isolated electric lamps on the streets. The gas company fought desperately in the interest of their monopoly, claiming under their charter the exclusive right to light the streets, and threatening suits for damages, finally bringing suit against the city. Col. T. S. King, the Brush Company's irrepressible manager, then came before the Minneapolis aldermen with a speech after the order of Cicero's "Conspiracy of Catiline," denouncing the unfair action of the gas monopolists, since which time the electric light company's success has only been equaled by the energy of the Minneapolis census-taker. In July last the company obtained a two years' contract from the city, under which they now have 225 Brush lamps burning on the streets (amounting to $45,000 per annum), and the number will doubtless be doubled early next season. The "danger" which the gas mayor saw originally is apparent, when we say that instead of $36 per post per year, and the city furnish posts, etc., the gas company now furnish posts and all in the territory it is still allowed to light, and gets but $15.63 per post; while, in addition to the reduction of $1 per thousand to private consumers, the gas company promises a further reduction of 75 cents at an early day, and the "danger" signal is still out.

The Minneapolis Brush Company have fittingly demonstrated what Western energy and enterprise can accomplish. They fought their way into the city, and have fought the gas company ever since (resulting in the saving of vast sums to the entire city in the reduced price of gas), building up a large and profitable business in the face of an opposition as powerful as it was relentless, until today there are few companies in the United States with so large and satisfactory a business or as brilliant prospects for the future.

Their lighting station is a brick and stone building, 60 x 140 feet, basement and one story, and the power plant consists of three Reynolds-Corliss condensing engines, aggregating 700 horse-power. Their present dynamo capacity amounts to 530 lights (450 of which are in operation), and they have ample room in their station to run three times that number, as they will do, at the present rate of increase, having doubled the number of lights within the past six months, and the business is still growing rapidly.

The company are fortunate in securing cheap fuel from a saw-mill about 500 feet distant from their lighting station. During six or seven months of the year, while this saw-mill is in operation, the large amount of sawdust made is a nuisance to the millowner, and he gives it to the Brush Company, who remove it and drop what is required into their boiler-room by means of a conveyor. The sawdust is spouted into the conveyor at the mill, and the Brush Company drive the machinery which propels said conveyor. This not only supplies them with fuel at a merely nominal cost during six or seven months, but furnishes a surplus which is stored adjacent to their station, and used after the mill is closed, so that sawdust is the only fuel used during eight or nine months of the year.

The plant, as a whole, is a model one, and Minneapolis, the Queen City of the great Northwest, with her 130,000 souls, can rejoice in the grand success of the Brush Company. We learn that the company, having secured so firm a footing with the arc, are turning their attention to the incandescent field, and the Brush-Swan system illuminates and adorns the City Hall, flouring mills, etc. They propose also to develop the interests of the Brush-Swan in the other important cities of Minnesota at once.

* * If the reported hardening of the copper market develops into a positive advance in the price of ingot there will be a great "racket" in the Boston stock market.—*Transcript.*

* * Explosions are said to be transmitted through dynamite at the rate of 20,000 to 24,000 feet per second. It is this rapidity of explosion that makes dynamite so destructive when detonated on the ground or in the open air. The latter acts as the tamping, being unable to yield quickly enough to relieve the pressure on other objects, such as the earth.

* * A locomotive driver who can point to forty years of uninterrupted service without a single accident is not a man to be met with every day. Such a one is a Saxon engine driver of the name of Henze, who has just gone into retirement. During his forty years of railway riding, Henze has traveled a distance of 253,347 geographical miles, or 1,900,102 kilometers, in other words, a distance equal to forty seven journeys round the earth.

* * The German Government is having a deep shaft sunk near Schladeback, with the view of obtaining trustworthy data concerning the rate of increase in the earth's temperature as we descend into the interior. The excavation is being carried on by a diamond-tipped borer driven by water. At the beginning of 1885 the shaft had reached a depth of 4,640 ft. The temperature at successive stages is ascertained by an instrument which serves as a special thermometer, the principle of construction being that, as the heat increases, the mercury will expand so as to flow over the lip of a sufficiently short open tube in greater and greater quantities. The measurement of the differences of these overflows will give the rate of increase of the temperature It has been ascertained that the temperature at the depth of 4,640 ft. was 130° Fahr. If the temperature increases regularly at this rate, the boiling point of water ought to be reached at a depth of 10,000 ft.

On the Theory of the Electro-Magnetic Telephone-Transmitter.

By M. E. Mercadier.

The first point to be studied in this theory is the part played by the iron or steel diaphragm of the telephone.

1. From the *elastic* point of view as regards the nature of the movements which it effects. 2. From the *magnetic* point of view, in the transformation of mechanical energy into magnetic energy resulting from its movements.

I. If there are produced in the air in front of the diaphragm vibratory movements, simple or complex, like those resulting from articulate speech, either the fundamental and harmonic sounds of the diaphragm are not produced or they play merely a secondary part.

In fact: 1. The diaphragms are never set in vibration, as it is supposed, if we wish to determine the series of the harmonics and of the nodal lines; for they are not left to themselves when they have been set in motion; no free play is given to the action of the elastic forces; in a word, the vibrations effected are constantly forced.

2. If a disc is absolutely set in a groove, when its borders are fixed, theory indicates that the first harmonics of the free disc ought to rise only a little. Let us take discs of steel of 0.10 meter in diameter, and only 0.002 meter in thickness, the fundamental sound of which, in the free state, is about ut_5 and which is further raised by framing in. We do not see how this fundamental and the harmonics can be brought into play when there is produced before the disc a continuous series of sounds or of accords of a pitch below ut_5 or when a man, the pitch of whose articulate speech is always in the gamut of index 3, speaks into a diaphragm of this kind. Nevertheless, these sounds and this speech are perfectly reproduced (with a feeble intensity, indeed, in an ordinary telephone) with their pitch and their timbre They produce, therefore, in the transmitting diaphragm, movements other than those of the fundamental sound and of its particular harmonics.

3. It is true that in practice the edges of the telephonic diaphragm are in no manner fixed, but merely enclosed between pieces of wood or of metal, the mass of which is comparable to their own; they are, therefore, as regards elasticity in conditions, not well determined. Still, a diaphragm of ordinary diameter (from 0.05 to 0.10 meter) and very thin (from 0.25 to 0.5 millimeters in thickness), enclosed in this manner at its edge, is capable of vibrating if a continuous series of sounds is produced near it, by means, for instance, of a series of organ pipes. But the series of sounds which it distinctly strengthens by manifesting complex nodal lines is visibly *discontinuous;* how, therefore, can its existence suffice to explain the production of a continuous scale of sounds—sounds, isolated or superimposed, which is the essential property of the telephone?

4. The interposition between the diaphragm and the source of the vibratory movements of a plate of any substance whatever, in no wise affects its telephonic qualities, nor, consequently, the nature of the movements, which would be very surprising if it were these which correspond to the particular sounds of the diaphragm. This fact is already known. I have verified it with mica, glass, zinc, copper, cork, cotton, wood, paper, feathers, soft wax, sand and water, taking certain of these substances even in thicknesses of 0.15 to 0.20 meter.

5. We may put a diaphragm manifestly out of condition to produce its particular scale of harmonic sounds, by loading it with small masses irregularly distributed over its surface, by cutting it in form of a wheel, or of piercing it with holes, so as to deprive it of the half of its mass. None of these modifications destroys its telephonic properties.

6. We may go still further and employ diaphragms of a rigidity and elasticity almost *nil*, without affecting the essential telephonic properties, that is, the reproduction of a continuous series of sounds of accords, etc Such is the case with a diaphragm of sheet-iron. It is very difficult then to imagine a fundamental sound and its harmonics.

The conclusion of all this seems to me to be that the mechanism in virtue of which telephonic diaphragms execute their movements is at least analogous to, if not identical with, that by which solid bodies of any form —a wall, for instance—transmit to one of their surfaces all the vibratory movements, simple or complex, successive or simultaneous, and varying in period in a continuous or discontinuous manner, which are produced in the air in contact with the other surface. In a word, we have here a phenomenon of *resonance.* In diaphragms of a sufficient thickness, this kind of movement would exist alone; in slender diaphragms the movements corresponding to their particular sounds may be superposed on the former; a superposition more troublesome than useful, for if there results in these cases a strengthening of the effects produced, it is at the expense of the timbre, as the harmonics of the diaphragm can only by the greatest chance coincide with those of the sounds which bring into play the fundamental sound of the diaphragm, as experience distinctly proves.

II. Let us now pass to the magnetic part of the telephonic diaphragm. This part may be clearly defined by the following facts:

1. The presence of the magnetic field does not at all modify the foregoing conclusions.

2. By diminishing more and more the rigidity and elasticity of the diaphragm, I succeeded in suppressing it completely. It is sufficient to substitute for it in any telephone, a few grains of iron-filings, thrown upon the pole of the magnet, covered with a piece of paper or pasteboard, in order to reproduce, though with a very feeble intensity, all sounds and articulate speech, with its characteristic tone.

3. To augment the intensity of the effect produced, it is sufficient to substitute for the iron diaphragm, a slender disc of any substance, slightly flexible, whether metallic or not, *e. g.*, pasteboard, and to spread over it, across the opening of the ordinary cover of the instrument 0.1 or 0.2 grm. of iron filings, which marks out in the space the lines of force.

We obtain thus an iron-filings telephone. By suitably increasing the intensity of the magnetic field, I have been able to obtain telephones of this kind, producing in an ordinary recipient, effects as intense as the ordinary transmitters with rigid diaphragms, and like them, reversible. For a field of given intensity, there is a weight of filings which produces a maximum effect.

We see thus that the advantage of an iron diaphragm over filings is reduced to presenting in one and the same volume, a much more considerable number of magnetic molecules to the action of the field and to external actions. It increases the intensity of telephonic effects; but to produce them with all their variety, their delicacy and their perfection, it is by no means indispensable: it is sufficient to materialize in some manner the lines of force with iron-filings, and to act mechanically upon them, and consequently upon the field itself.—*Comptes Rendus.*

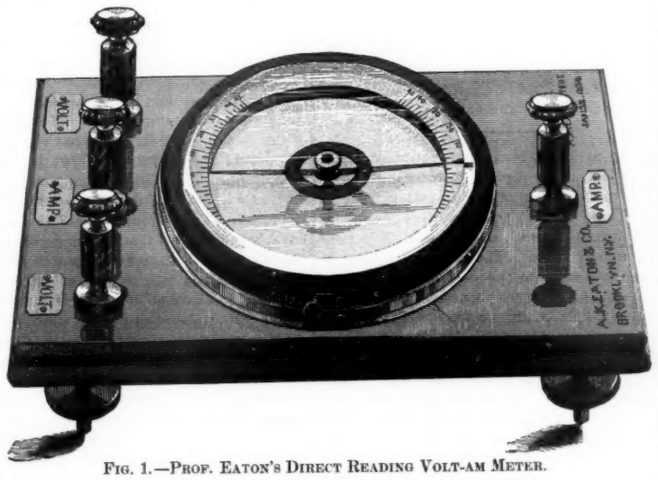

Fig. 1.—Prof. Eaton's Direct Reading Volt-am Meter.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Mr. J. Viennot, 150 South Fourth Street, Philadelphia, is our accredited representative for Pennsylvania.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill, will represent the REVIEW in the West.

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NEW YORK, DECEMBER 5, 1885.

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It is reported from Washington that Secretary Lamar has decided to recommend that suit be brought to set aside the Bell telephone patents, but up to the hour of going to press the rumor had not been authenticated.

The press of Philadelphia request the electrical companies of that city to fix a date when they will put their wires underground. This is very considerate, particularly as it comes after the defeat of the ordinance ordering the wires underground at once.

We learn that the Dorsett conduit ordinance has been passed by the Common Council of Milwaukee, and signed by the Mayor. This insures a good underground system in that city. At Detroit the Common Council has passed an ordinance requiring all wires within half a mile of the City Hall to be placed underground before January 1, 1886, and all within one mile to be placed underground by January 1, 1887. The underground system used in Detroit is the Dorsett, and we are informed that the work is so far advanced that it will be an easy matter to comply with the terms of the ordinance.

Secretary Lamar has extended the time for filing briefs in the great case argued recently, as counsel for the Bell and Globe companies have stated to him that they required more time to prepare their cases.

The Chicago Post-office is to have an increased electric light plant, the United States Company having just contracted for 250 additional lamps of 16 candle-power, and 25 lamps of 125 candle-power. The Government seems to appreciate the advantages of the electric light.

Neither the New York nor Brooklyn Electrical Subway Commissioners have received one cent of their salaries. The law creating the Commission provided that the electrical companies of the respective cities should bear this expense, and as the said companies have not seen fit to send in their checks the Commissioners have been compelled to bear all expenses from their personal accounts.

On the first of this month Mr. George M. Phelps retired from the superintendency of the Western Electric Company in this city. With hosts of others we regret that the extensive private interests of this courteous and capable gentleman compel this change. We shall be pleased to hear, in the not distant future, that he has decided to again enter the electrical field, where his work has always been intelligent and his presence most popular. Mr. Phelps is succeeded by Mr. T. W. Lane, a worthy gentleman, of whose special qualifications for the position the REVIEW made mention in a recent issue.

At Syracuse, N. Y., last Saturday, Judge Wallace, in the United States Court, heard the presentation of additional evidence in the case of the American Bell Telephone Company against the People's Telephone Company *et al.* The case practically resolves itself into the question whether the electric speaking telephone was first invented by Mr. Bell or by Mr. Daniel Drawbaugh. By a recent opinion handed down by Judge Wallace, the Bell patents were to stand, but the judge expressed some doubt on certain points, and the hearing is by a stipulation to reopen the case for the introduction of additional evidence on these points. The question is under consideration by the judge.

Cincinnati is happy over its new time system. We have before stated that the popularity of the telephone service in that city is unsurpassed in any city in the United States, and the enterprising general manager, Captain G. M. Stone, has increased that popularity by adopting the Oram telephonic time repeater for all the territory controlled by his company, to continue through the life of the patents. This system, which furnishes every subscriber the exact time, day or night, does not increase the rental of the telephones, but is a valuable gift from the company. Before adopting the system it was placed on trial, and Captain Stone requested the subscribers to let him know what they thought of it. The unanimity with which every one sent in his commendation of the increased value of the service left no room for doubt, and every telephone in Cincinnati is now a reliable time piece.

There was nothing in the visit of the members of the New York Subway Commission to Chicago which had the slightest flavor of a junketing party. Everything smacked strongly of business, and business alone. The coming was unheralded by any blare of trumpets; unostentatious and modest—their proceedings quiet but thorough, and their departure deliberate. Their presence in the city was comparatively unknown to the masses, and the interviewing reporters of the daily press, while respectfully treated, did not obtain material for the publication of either laudatory congratulations or condemnatory flings from the pens of the erudite gentlemen of the various reportorial corps; in short, so quietly transacted was everything pertaining to their visit that, beside the usual accumulation of gaping wonder-seekers which gathered at each open man-hole of the various underground systems examined, there was no sensation resultant from their labors of inspection. A full report of their two-days' examination of the various forms of underground wire-ways in Chicago will be found in our General Western News.

Cleveland, Ohio, is the center of the electric-light carbon trade of the country, and more carbons are, probably, produced there than in all the rest of the world combined. There are, besides, large factories in St. Louis, Pittsburgh, and Ansonia, Conn. The first manufacturers were the Brush Company, of Cleveland, and a large and profitable business was built up by this enterprising company. It is estimated that in one year they cleared a profit of $200,000, and now manufacture from fifteen to twenty millions annually. The Boulton Company, of Cleveland, with Mr. W. U. Masters as the energetic head, entered the field about four years ago, and his company is now known wherever the electric-light has penetrated. The Wallace company, at Ansonia, is also a well-known carbon manufactory, and more recently the Parker-Russell Company, of St. Louis, the Pittsburgh Carbon Company and the Forest City Carbon Company, of Cleveland, have come to the front, and are engaged in extensive manufacture; and all of these have been called into existence by the demands of the electric-light business. The first manufacturers made splendid profits, ut of late sharp competition has made this considerably less, and has been the means of bringing the price down, much to the delight of the local electric-light companies. Carbon pencils first sold at $62.50 per thousand, then dropped to $50, to $40, and then to $32, where for several months the price remained stationary. Then it dropped to $22.50, and we have been informed that, in some cases, the cut reached as low as $10.00 per thousand. Within the past two months an effort has been made to have an understanding reached by the carbon manufacturers by which prices could be maintained, but the meeting for this purpose has been postponed from time to time, and that it will ever be held is very doubtful. This state of things is what pleases the consumer, and makes the competition for his trade very lively and watchful. It is probably true that the price has dropped as low as the expenses of manufacture will permit, and in some instances to less than cost; and unless some new and cheaper process of turning out first-class carbons is discovered the consumer can expect no better terms than he is able to make to-day, and we believe he is pretty well satisfied as it is.

COMMISSIONER SQUIRE FORSAKES THE MUSE AND TAKES UP THE UNDERGROUND PROBLEM.

Speaking to a reporter of one of our daily contemporaries last week regarding the collection in one underground conduit, sewer pipes, water-mains, gas and steam pipes and electric mains, Commissioner Squire said:

"There are 361 miles of paved streets on Manhattan Island, and under the pavements there are 412 miles of sewers, 561 miles of water pipes, 850 miles of gas pipes, 16 miles of steam pipes and 21 miles of electric wires. These include only the main lines and not the lateral connections with buildings. The average cost of constructing subways to contain these underground structures, and those which may hereafter be placed under the streets of the city, would be not less than $50 per lineal foot, or $264,000 per mile. Would any taxpayer undertake to procure the necessary legislation, authority and funds to build 50, or 100, or 200, or 300 miles of such subways and compel the gas companies, the steam companies and the telegraph companies to remove all their present conduits and substructures and place them in the proposed subways? The probability is that he would be appalled at the proposition to tax him proportionately for such expenditure."

Commissioner Squire means well, but allows himself to be carried away by this subject, and a subject, too, which it is easy to see he does not fully understand.

If there is any scheme afoot to subway the streets as they are subwayed in Paris—for practically speaking this would have to be done to accommodate all the pipes Mr. Squire enumerates—we have not heard of it, and would be much obliged to Mr. Squire if he would inform us as to those seriously urging such a measure.

But because it is not practicable to do this, does not necessarily condemn every other means of burying the wires. Water pipes and gas pipes and sewer pipes are not a necessary adjunct to electric mains, and while no practical business men that we know of are urging the general excavation of the city's avenues and streets, they are advising a general sinking of the electric wires, and have done not a little, as the REVIEW showed last week, to prove the feasibility of the scheme.

The REVIEW has all along espoused the conservative course of showing the advantages and disadvantages of both underground aerial systems, and even if this were not the case, it would not utterly condemn any plan because it could not be carried out in a certain way.

AS TO THE TELEPHONE ON THE SWIN LIGHTSHIP.

The experiments recently made with a marine telephone on the east coast of England as described in our last number, are interesting and the possibilities of the instrument in marine service are easily seen to be great. Yet it is difficult to see that the telephone operated in the lightship in the Swin passage, ten miles out to sea, has given any better results than were long since attained by the telegraph, which, as we know, has been readily worked at sea several thousand miles from land.

Speaking of the work of the Telegraph Construction and Maintenance Company's telephone in the lightship, the account says:

"A button is touched which rings a bell in Mr. Stevenson's cabin upon the lightship ten miles away, then a voice—that of Mr. Stevenson—is heard inquiring what is wanted. 'How is the wind?' 'How is the tide?' 'Have you seen such and such a ship pass?' 'How much water is there in the Swin passage?' These questions can be answered at once," etc.

If it is only meant by this to show that a telephone can be worked at sea ten miles from shore, the experiments have a certain importance, but if the telephone company believes that answers to such questions by telephone can have a value to any human being connected with the sea or shipping, they should consult some marine authority and learn without delay that they have absolutely none. Any person with money enough to buy a cheap almanac can learn all about the tides on the east coast of England without the use of telephone or telegraph, and by consulting an admiralty chart can learn how much water there is at the Swin lightship at mean low water and make their calculations for any condition of tide and effect of certain winds in raising and depressing them. All they have to know which will not be furnished by the almanac and the chart is the direction of the wind, and if they are blind and cannot see the weather vanes or how the sailing craft are trimming their sails, they can invest a penny in a newspaper and get some kind friend to read them the Government weather report. As to the signaling of vessels to change their courses, there would never be any need of telephone or telegraph to perform such a service, because the coming of a vessel is transmitted so long in advance of her arrival to her consignees that if there is any advanced station, they have ample time to send lengthy and minute instructions to her master by outgoing vessels calling at the station.

Important uses are likely to be found in the future for the marine telephone, but it is not at all probable that any of these uses will lie in this direction.

GENERAL WESTERN NEWS.

Well, the New York Subway Commission has paid us a visit and thoroughly inspected the plans in use in this city for underground wires, after having previously carefully investigated the many theoretical propositions which had been laid before it, and having personally examined the existing plants in Eastern cities.

The party, which consisted of Mr. Chas. E. Loew, President of the commission, Mr. Jacob Hess, and Mr. John Thomson, mechanical expert, representing Mr. Theodore Moss, secretary, business preventing the latter gentleman from accompanying his brother members of the commission, congregated at the Grand Pacific Hotel on Monday the 23d.

Accompanying the commission were Messrs. A. J. Dam and George Worthington of the REVIEW, Mr. R. W. Pope, of the *Electrician and Electrical Engineer*, and Mr. W. H. Johnstone of the American Sectional Company, of Philadelphia· a city official, and Mr. D. H. Dorsett, the inventor, and Mr. F. W. Cushing, superintendent of the Chicago Electrical Sectional Underground Company, completed the party of tourists which started from the hotel Monday forenoon to see how wires are put underground in Chicago.

The weather was far from being propitious, but that to the average inhabitant of this locality is nothing, and our Eastern friends, impressed with the necessity of attending strictly to business, ignored the raw, damp air, and plodded through the dirty walks as if "to the manor born."

The first stop was made at the corner of Madison and Washington streets, where a man-hole had already been opened by employes of the Western Electric Company, who were preparing to pull in a cable.

In this man-hole, which is part of the Dorsett system, two wires were examined, which Mr. Cushing explained were in use by the Sperry Company upon an arc circuit of forty lights. These wires are only covered by wrapping where they pass through the man hole, to prevent contact by persons working around them on other wires in the conduit. From this, the *Daily Tribune* corner, running north over half way to Washington street, these wires have no insulation, being second hand wires taken off a disused dynamo coil, which was originally wound with single cotton-warp insulation, but without any other covering or insulating compound. The greater portion of this cotton covering had been stripped off, as it was taken from a lot of refuse wire. Through this virtually naked wire, without insulation save the conduit proper. The lights above referred to have been burning nightly for over five months, without interruption or failure from ground disturbances.

This wire, or rather wires—for the gauge being too small for the purpose, if only one were used, was composed of two wires in either duct. The laying of this line in this manner, as chronicled at the time in these columns, was an experiment made for the purpose of testing two mooted points: The insulating properties of the conduit material with currents of high E.M.F., and the possibility of the conduit condensing moisture, and so rendering a ground contact possible.

The experiment has abundantly proven the excellence of the Dorsett conduit in both particulars.

From this point the party proceeded to the corner of Dearborn and Washington, where preparations were being made for forcing a leading wire through the conduit, by a machine which is a Chicago invention. The wire, a No. 4 iron, is sent downward from a reel through a curved pipe until it reaches the duct, and is pushed forward by means of friction rollers, the end of the wire being arranged to prevent its catching in its onward progress.

Having satisfactorily watched the process of placing the leading wire by which the cable was to be drawn in, and disentangled themselves from the crowd of hangers-on who had congregated, the party proceeded to the corner of Washington and La Salle.

Here they had been preceded by the "can openers," as Mr. Cushing designated the individuals who were to open the man-holes for the inspection. One of these—the man-hole, not the can-opener—was opened for the visitors, and Mr. Cushing pointed out the different wires and their branch of service. Mr. Dorsett here made a little speech, of the neat but not gaudy style, suggesting to the gentlemen of the commission that he would much prefer not to select the man-holes to be opened, but that of an hundred and fifty or more scattered through the city, any one, or the whole number in use would be opened, if the commissioners would kindly particularize any locality or number which they desired to take a peep at the internal arrangements of.

The commissioners suggested that what they desired to do was to accomplish as much investigating as possible with the least amount of walking. Another hole was then opened, examined and left to the "can-openers," when the party adjourned to the Fire Alarm office, where they were introduced to Prof. Barrett, the head of the Electrical Department of the city, and also to Chief Swenie, of the Fire Department.

Here the question of how well a telephone line would work underground, was sprung and a connection was called for through the telephone.

The wire in this case ran from the fire alarm office through the conduit alongside the fire-alarm wires, within a short distance of the Edison light wires in the City Hall, which were in operation, all the lights in the room being turned on, through the conduit to the central office, thence back past the City Hall, and northward through three miles of conduit and about six miles of overhead wire. Conversation was easy, and the result pronounced satisfactory by all.

By this time the conduit containing the city wires, police, fire, telephone and electric light, leading into the City Hall, was exposed to view by the laborers, and the perfect network of these was shown in all their variety.

It was suggested that a visit to the Dorsett factory would be in order. This being located far over on the north side, conveyance other than that provided by nature was necessary. Accordingly, carriages were procured, and the party were driven northward.

At the corner of Chestnut place and Clark street, and at another corner near by, the procession halted and witnessed the process of laying and cementing the sections of pipe, and the manner of joining these to the man-hole.

The factory was in full operation. The moulds, made in halves and clamped together, are fastened upright beneath the hammer. From below seven brass rods, like huge mould candles, project upward through the open mouthed mould. The hot mixture is brought to the hungry, gaping mouth in a saucepan with a removable bottom. This is placed on the mouth, when, with a dexterous touch, the tin bottom which holds the food is pushed from under the dish, and the savory mass goes down the monster's neck steaming hot. The dish is removed, a turn of a lever, the rammer follows the food, and pounds it with many blows into the swarthy gormandizer's maw. Again and again are these rations fed, until the creature is surfeited—the mould is full.

A stream of water is thrown downward through the brass candles, and in a short time these are drawn out from the bottom. A crane reaches out, grips the mould, swings it away and sets it carefully into a baptismal font of cold water, whence it is lifted a section of underground conduit. A few blows of a hammer releases it from the iron jacket by loosening the keys, a reamer removes the superfluous material round the mouth of the ducts, and it is ready for its burial ceremony.

The entire process of manufacture, from the molten, seething mass to the finishing touch, is hardly of longer duration than is required to describe it on paper.

The machines are the invention of Mr. Dorsett's able assistant, Mr. J. R. Burdick, and one of these is capable of turning out 100 conduit sections in ten hours.

The formation of the man-holes next claimed attention. These are of such dimensions as to require to be made in sections, and afterwards put together by a process similar to that of joining the sections of conduit. A marked peculiarity of the Dorsett material is that any two pieces may be joined as perfectly as if originally of but one mass. A pipe may thus be let into a man-hole at any angle and from any direction, and, when the jointure is completed, the mass is as perfectly homogeneous as any portion of the system.

The man-holes seen by the party being of different dimensions from those which had been examined in place, inquiry brought out the fact that these are for the city's use in connection with the water-works system, and are for hydrant and stop-cock chambers The city has placed something like a hundred per month of these in the past two or three years, and daily requires more of them

Then the Dorsett distribution system was illustrated by an object lesson—short metal pipes, lined with the compound, for short connections at hand-holes. For the lengths purposed to be thus treated, an objection was made that the shrinking and expansion of the metal tubing might work mischief; but, when the matter was mathematically figured, the objector gracefully withdrew his suggestion.

From here the party were driven back to the rallying point, the Grand Pacific, whence a new departure was taken, in accordance with an invitation from General Manager Fay, to visit the telephone exchange at 125 La Salle.

Supt. Sunny went carefully through the system, and explained that there were some 1,500 wires in this particular central office, which is only one of eight in the city. A great number of experiments were made with underground telephone wires. From here, at Mr. Sunny's suggestion, the party adjourned to one of the company's branch messenger offices, under the Grand Pacific, and here were shown no less than 467 wires, by actual count, running into the Dorsett conduit, conversation through which was as perfect and complete as could be wished.

The advantages of cables over the old system of bringing lines to the central office, their freedom from mechanical difficulty and interference, were plainly shown. A last experiment with the telephone was subsequently made between the corner of La Salle and Randolph and Highland Park, Illinois, where Prof. Elisha Gray resides. In this experiment the wire for two miles and upward is through the conduit, while twenty-three miles are overhead. In addition to this, the communication was made through three exchanges. The working was everything that could be asked.

The party now returned to the Grand Pacific, where, after a short conference, they separated, and in sections sought for that relief which hungry nature demands at the hands of a *chef de cuisine*.

During the entire trip—and the day was far advanced before they had finished this part of their labors—nothing had been done to bias the minds or actions of the commission in any form. Every facility had been given for a full, thorough and complete inspection of the system, and everything was apparently satisfactory.

In the evening the outside members of the expedition enjoyed a theatrical exhibition—a French opera—as being something all could equally well comprehend, where there were no technicalities to confuse one more than another—a plane where all could meet on a common level, without prejudice, without jealousy or misunderstanding.

Tuesday a different programme was followed. Messrs. Thomson and Pope paid a visit to the Western Electric Company's extensive works, where a personally-conducted excursion, under the guidance of Messrs. Smoot and Patterson, permitted them to receive instruction in the manufacture of Patterson cables, electric light and other apparatus.

The last meeting of the Milwaukee Council was somewhat tumultuous. The president of the council being away on a vacation or business, it became necessary to elect a *pro tem.* officer to fill the chair. It being the last meeting of the board previous to December 1, the special tax assessment had to be arranged for, or the city would be left in grievous legal complications. After a long series of ballotings, a two-thirds vote resulted in the selection of Alderman Baumgaertner.

After some other business was disposed of the Dorsett ordinance came up, and an amendment, substituting eight for five miles of conduits required to be constructed next year, was adopted. Another amendment, relative to sidewalk area privileges, was attempted, but failed of adoption, and the ordinance, as amended, was passed. It now only requires the Mayor's signature, which is said to be assured, to become a law, and peace will probably reign in Warsaw.

One of our leading dailies recently published the following, from which the dear public might be led to believe that the plant referred to was a sort of crazy patch-work, which had been put up and grew by the cut-and-try rule. The fact is, this exhibit was its first attempt, and, as the article states truly, was perfectly successful:

"The electric light plant in the county building was in successful operation for the first time yesterday. It is not as satisfactory as the city hall light, nor are the fixtures placed in so attractive a style."

The plant is one of five which the United States Company are just completing for this county. In addition to this, the plant in the post-office, which was shut down last summer, as then stated in these columns, will soon be in operation again, considerably increased in size. The present plant includes 1,000 16-candle United States lamps. This is to be increased at once by 250 16-candle-power lamps, and 60 Moguls of 150 candle-power each. When finished the entire post-office department and appurtenances, corridors, etc., will be lighted. The public, no less than the employes of the building, will have cause to rejoice at the change.

Col. Lynch at 144 La Salle street reports telephone stock values as follows:

Chicago	$375	@	$400
Central Union	51	@	53
Michigan	65	@	67
Iowa Union	18	@	20
Great Southern	28	@	30
Colorado	15	@	20
Rocky Mountain Bell	40	@	45
Mo. & Kas.	55	@	57
United	14	@	15
Cumberland	70	@	75
Wisconsin	110	@	112

CHICAGO, Dec. 4, 1885.

MICHIGAN TO BE WELL COVERED WITH OPPOSITION LINES.

The Michigan Postal Telegraph Company, of which George Farnsworth, of Detroit, is manager, has completed the planting of the poles for the line from Detroit to Bay City and East Saginaw, and will shortly commence stringing the wires, which have been already shipped to the front. Work is already under way also on the Chicago line, poles having been sent west from Detroit as far as Wayne. This line will run through Jackson, Lansing, Battle Creek, Kalamazoo, Niles and Michigan City. The line will be completed to Jackson and Lansing, and perhaps farther, this winter. It is the intention also to build a line immediately from Lansing to Grand Rapids In fact all important points in the State will be reached by the wires of this company. The Michican Postal Telegraph also owns lines from Detroit to Toledo, Fostoria and Cleveland, O., which are under lease to the United Lines, with which the Michigan Postal will work in direct connection, handling the Michigan end of the business. The United Lines already reach most of the important cities of the North and East directly, and those of the South through the Baltimore and Ohio Lines with which they connect. The Grand Rapids and Indiana Lines already work with the United Lines on West Michigan business, and, as soon as the intersection is made, will work still more directly with the Michigan Postal Lines. The United Lines are pushing forward the plans of the Bankers and Merchants', to whose business they succeed, in extending the scope of operations to new territories, and Mr. Farnsworth, who is also the Detroit manager of the United Lines, promises that as soon as the Postal Telegraph wires are stretched his company will give Michigan as complete and efficient telegraph service as the old established Western Union.

Telephonic News

The Telephone Tit Willow.

He slapped at his chest and uttered a vow,
Sounding "Hello, oh! Hello, oh! Hello!"
And a cold perspiration bespangled his brow—
"Oh, Hello, oh! Hello, oh! Hello!"
He sobbed and he sighed, and he grew very pale,
And an echo arose like an agonized wail,
As piercing as the tap on a tin dinner pail,
"Oh, Hello, oh! Hello, oh! Hello!"

It was almost as certain as life that his name
Wasn't "Hello, oh! Hello, oh! Hello!"
But 'twas a powerful passion that made him exclaim,
"Oh, Hello, oh! Hello, oh! Hello!"
Then his voice dropped into a perilous sigh;
He perished right there—and would you know why?
Because, tightly lodged in his throat was the cry:
"Oh, Hello, oh! Hello, oh! Hello!"

—*Minneapolis Tribune.*

⁂ Electrical instrument makers are in demand. Just now some are wanted in the West, as our advertising columns show.

⁂ Mr. F. A. Sackman, of Cleveland, is receiving a number of orders for his steel stamps for names and numbers from the telephone and electric light people. These are very convenient in telephone exchanges and light stations for numbering lines and locating connections.

⁂ There is a man in San Francisco who has four ears. What advantage there may be in this double supply has not yet been reported. But it may be only the first example of an improved humanity. No one can tell where evolution will bring up. Anyhow, we think the gentleman might be useful in a telephone exchange.

⁂ A sergeant in the United States Signal Corps invented a field telephone, a marvel of simplicity as well as ingenuity, an instrument, it is stated, that was so simple and yet so perfect that it could be exposed for weeks to the weather in a field, or lie buried in an ash heap, and not be injured. The Signal Office made use of these instruments for some time.

⁂ Superintendent Walker, of the Electrical Department, Philadelphia, says that none of the telegraph or telephone companies have taken any steps toward putting their wires underground, as provided by Act of Councils passed last June, and that he should be obliged to cut down all overhead wires on January 1 unless he received orders to the contrary.

⁂ Mr. F. E. Degenhardt, representing the Standard Underground Cable Co., of Pittsburgh, Pa., showed the working of the Waring underground system to the New York Subway Commission at Chicago, last week. Mr. Degenhardt is one of the ablest cable men in the business, a courteous and capable representative, and did good work for his company on this occasion.

⁂ Still the enterprising telephone man is at work in the West. The Topeka (Kansas) *Capital*, of recent date, has the following: "Yesterday the Missouri and Kansas Telephone Association completed the second line from Kansas City to Leavenworth, making a total length of lines owned by this company of 900 miles. Within a week from this time, they will also have completed a line of telephone to Burlingame, Osage county, twenty-six miles in length, thus opening up, via Osage City, communication with Ottawa, Franklin county. The line from Osage City to Ottawa, about forty miles in length, running through Lyndon, Quenemo and Pomona, will soon be thoroughly overhauled, and put in as effective condition as the other lines. The young cities of the Missouri valley now communicate with each other by a complete network of wires, over a dozen being within hailing distance of each other. The Missouri and Kansas Telephone Association have shown commendable energy.

⁂ The Greenville (Miss.) and Vicksburg Telegraph Company have completed their private telephone lines as far as Terrene, at the mouth of White River. This will be a great convenience for steamboatmen to communicate with the outer world. Offices will be opened within a few days at all points along the Mississippi River from Sunflower Landing to Brunswick Point. These telephone lines are in direct connection with all Western Union Telegraph offices in the United States.

⁂ The Kansas City employes of the Missouri and Kansas Telephone Company give their second annual ball Thursday evening, Dec. 10, and the President and Secretary, Mr. D. B. Macquarrie kindly remembers the REVIEW with an invitation and complimentaries. Prof. C. W. Gandy is announced in charge of the "electrical exhibition," and Miss Ella Gilmore, from the central office, will be chief operator of the branch exchange which will be in operation at the music hall. This entertainment will undoubtedly be a pleasant one, and should be well patronized by the many patrons of the exchange.

⁂ Prof. Graham Bell, the telephone inventor, attending the National Academy of Sciences, in Albany, said, concerning the future of long-distance telephoning: "We feel greatly encouraged at the present development in that direction. We are building a 15-wire line from New York to Philadelphia now, and shall continue extending the plant. Our line between New York and Boston works admirably. To avoid the effects of induction on the Boston wire, we use a second, or return wire, which makes practically two wires, just as they used to do in telegraphing. I think there is no practical limit to long-distance telephoning. If it was not for induction, you could run a wire across the continent and talk through it. An invention that would do away with induction would be worth a good deal."

⁂ Prof. W. E. Ayrton writes upon the subject of mechanical telephones to *Nature* as follows: "In connection with the subject of mechanical telephones, which has been occupying public attention lately, there is a note by Mr. Miller in a recent number of *Nature* regarding certain experiments made in 1878 on the propagation of sound. With reference to this, Prof. Wernhold, of Chemnitz, stated that human speech could be transmitted very distinctly through stretched wires or threads, and mentions that the results of his researches were published in an article on 'The Transmission of Human Speech Through an Iron Wire,' in Carl's 'Repertorium fur Experimental Physik,' Band vi., Seric 168."

⁂ The introduction of the megaphone on shipboard—a sort of telescope for the ear, or machine for magnifying sound—is said to be a boon in prospect for mariners. Its design is to enable a person to hear or carry on a conversation with people at a distance, and it is constructed of two huge cone-shaped tubes, eight feet long and three in diameter at the large end, which diminish to an apex in the form of rubber tubes small enough to place in the ear. Between these tubes are two smaller ones, constructed in the same manner, but not more than half the diameter. By placing the rubber tubes in the ear and speaking through the smaller cones the person can hear and be heard at a long distance, and it thus aids mariners in listening for the sound of breakers, or carrying on conversation with persons on shore or on other vessels at a distance.

⁂ In a recent interview, General Manager Gifford, of the Louisville telephone system, which also includes several towns in Indiana, is reported as follows: "The telephone business in Indiana," said Manager Gifford, of the Louisville system, which includes New Albany and Jeffersonville, "is in this condition: If the Supreme Court of Indiana decides that the recent law (which makes $3 per month the highest rate that can be legally charged for telephones) is constitutional, the telephone companies will withdraw from the State, and leave it in its virginal condition of rural simplicity. There are already $600,000 of fines that may be enforced against the telephone companies in case the law stands. Well, they could not pay them, nor can they operate under the $3 law, except at a regular loss." Mr. Gifford says the law was passed by the rag-tag of the Legislature against the unanimous report of the committee to which the bill had been referred. This committee, Mr. Gifford says, examined the subject carefully, and learned that it cost upward of $4 per month on each instrument to operate the system and pay royalties. Consequently $5 a month is a necessary charge to enable the companies to pay any profit. The telephone companies charge that the bill was a purely blackmailing measure; but this is the usual cry. If the telephone companies can afford to give up business in Indiana as an alternative against reducing rates, they might be able to reduce the excessive royalty they pay the Bell Company by threatening to go out of business everywhere. "As it stands now," said Mr. Gifford, "we allow everything to go by default. Every time we attempt to charge $5, a constable would make eighty-five cents by serving notice of a suit upon us. Gov. Hendricks and ex-Senator McDonald are our attorneys, and if the Supreme Court, in December, decides against us, the telephone business will come to an end in the State of Indiana."

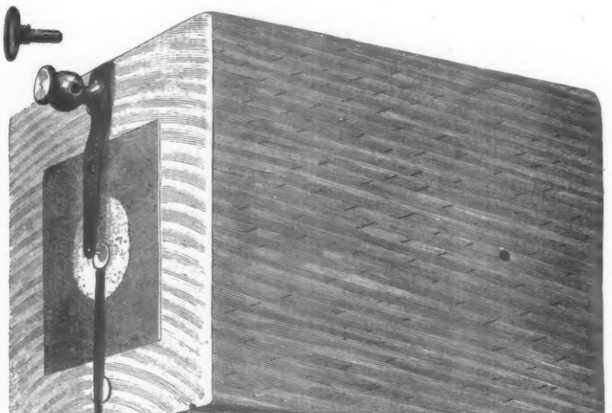


FIG. 1.—THE ORIGINAL REIS TRANSMITTER.

The Original Reis Transmitter and Receiver.

Our readers will be interested in the illustrations in this edition, which show the original transmitter and receiver which, it is stated, were used by Philip Reis in his lecture before the Physical Society of Frankfort, in 1861. The body of the transmitter (Fig. 1) consists of a block of wood pierced by a conical hole, over the smaller end of which a membrane is stretched. A strip of platinum connected to the middle of the membrane forms one electrode, and a thin strip of metal extending to the middle of the membrane, and provided with a platinum point, which rests on the platinum strip, forms the other electrode. The conical cavity forms the mouthpiece.

Fig. 2 shows the receiver open. The magnet is composed of a bobbin enclosing a knitting-needle, the ends of which extend beyond the bobbin, and are received in bridges on the resonant case. The terminals of the bobbin are connected with the electrodes of the transmitter, a battery being placed in the circuit. The idea was that sounds uttered in the mouthpiece of the transmitter would cause the transmitter membrane to vibrate and so produce changes in the current at the contact of the electrodes, the fluctuations of the current affecting the magnet of the receiver. These instruments, says the *Scientific American*, were received by Prof. Sylvanus Thompson from Dr. Theodore Stein, of Frankfort, and in order to verify their genuineness, the testimony of Dr. Stein was taken, and he stated that they were given to him by Prof. Bottger, in 1862, who assured him that they were produced and used by Reis at the meeting mentioned. Dr. Stein kept them in his possession until 1882, when he delivered them to Prof. Thompson.

The Wicked Telephone Girl.

There had been an unusual electrical disturbance, and the telephone girl had received several discouraging shocks while answering calls. As might have been expected, this soured her temper more or less, and when 585 called, she uttered her customary "hello" so snappishly that the manager, who sat by, knew somebody was about to suffer.

"Give me Mr. Bullwinkle's store please," said Mrs. Bullwinkle, who had called.

"All right! Is Mr. Bullwinkle there?"

"No, ma'am," replied one of the clerks.

"Do you know where he is?"

At this instant the heartless girl switched on Warpman, who was describing the gentleness of a horse he was about to purchase to one of his friends, and the reply Mrs. Bullwinkle got was:

"I was down to Farman's this afternoon, and when I went to the barn I found Farman's wife with her arms around his neck, and when I spoke about taking him away, she begin crying and said she would not be able to live without him."

"She did, eh?" said Mrs. Bullwinkle, into the transmitter. "The hussy!"

⁂ The following statement of the Nebraska Telephone Company, for the half year ending October 31, has been sent by Secretary L. H. Korty to the stockholders:

	For Quarter end'g July 31.	For Quarter end'g Oct. 31.
Gross Earnings	$27,169 59	$28,221 81
Gross Expense	17,050 25	17,065 62
Net Earnings	10,119 34	11,156 19
Increase Earnings over Previous Quarter	1,639 88	1,052 22
Increase Expenses over Previous Quarter	795 61	15 37
Increase Net Earnings over Previous Q'r't'r.	844 27	1,036 85
Per Cent. Expense to Earnings	62 5-6	60 4-10
Net Gain Paying Stations	77	53
Dividends Paid, Cash	$ 5,819 33	$ 5,836 00
Dividends Paid, Certificates (from surplus)		3,937 90

During the six months we have built the following lines:

Avoca, Iowa, to County line east... 12 miles.
Wilber, Neb., to Dewitt..... 8 miles.
Fremont, Neb., to Columbus. .....49 miles.

Total.....69 miles.

Besides providing for all ordinary exchange construction, this has been done out of earnings and the sale of 35 shares of treasury stock at par.

⁂ Secretary Lamar has decided that until a patent is delivered into the possession of the patentees it is not beyond recall by the Commissioner of Patents. The question came up in a case where the patent was signed by the Commissioner and Secretary, but was recalled before it was delivered, but the patentee claimed that within the meaning of the law the patent was issued and could not be recalled.

⁂ A new telephone system is about to be inaugurated in Ottawa. The combined result of these changes is that speech with good articulation can be modulated and distinctly heard at any distance within twenty and even thirty feet from the ear, thus avoiding all danger or annoyance, and at the same time liberating the hand from the fatigue of holding a telephone. It is intended to establish a manufactory in Ottawa.

⁂ A recent interesting exhibition of apparatus in Paris, by Dr. Boudet, included a modification of the telephone adapting the instrument to a variety of medical uses. In one form the pulsations of blood-vessels and all sorts of internal operations were very strikingly made audible, the observer being able to hear at will the movements in any part of the body. Another telephonic appliance detected the presence of stones in the bladder, and even made known their character when present. Dr. Boudet also employs the telephone as a measuring instrument for accurately estimating the nervous and muscular excitement in the different phases of a disease.

⁂ Most of the companies who have wires in the city have expressed their willingness to put their wires under ground as soon as they can practically do so, and active measures should undoubtedly be taken to compel them to go about their work as soon as possible. Under all the circumstances, however, it would seem that the most sensible method of solving the problem would be to make the companies fix a time—only reasonably far off - when they can put their wires under ground, give them until that time, and if they shall not have done so when the time arrives, proceed promptly to remove the wires from overhead.—*Phi'adelphia Call.*

⁂ A Chicago special to the daily *World*, of this city, says: "The New York Commission on Electrical Subways, Charles E. Loew, Jacob Hess and John Thomson, representing Theodore Moss, arrived in Chicago Sunday and devoted to-day to an examination of the conduit systems in use here. The commission has received over one hundred plans. As the streets of New York are already underlaid with gas and other pipes they determined that it would be necessary to examine all working systems before adopting any, as the one chosen will have a practical monopoly. They are most favorably impressed with the workings of the Chicago conduits, which they think, with some modifications, might be successfully introduced in New York.

⁂ Our contemporary, the *Tribune*, prints this paragraph in its nonsense column:

The speculative geniuses at the uptown pool-rooms are offering three to one that Secretary Lamar will open up the questions of the validity of the Bell Patents. The way they reason is that the South is in the saddle and it will ride, in this as in other matters where Southern men are interested against Northern men.

This is another exemplification of the *Tribune's* mistaken policy of creating distrust and ill-feeling between the sections. Why should Secretary Lamar unjustly disturb the Bell Telephone people? Simply because they are Northern men? This may be the estimate of Southern statesmen in the *Tribune* office, but what is this prejudice based upon? The Southern States are filled with Northern men and Northern capitalists. These men certainly find as much justice and fair dealing in the South as Southern men find in the North. What is to be gained by the insinuations which the *Tribune* is so fond of throwing off in its careless way affecting the integrity and honesty of Southern people? Nothing, we presume, save a prolongation of sectional hate.—*N. Y. Daily World, Nov.* 18.

The Telpher Line at Glynde.

On the 17th of last month the first Telpher line for actual commercial operation was inaugurated at Glynde, in England, where it is employed by the Essex Portland Cement Company to transport clay for a distance of about a mile from the point of excavation, and its operation is reported a complete success.

It may be well to remind our readers that a Telpher line is simply an overhead system for transporting material in small parcels by means of moving buckets of proper size running on rods supported by posts or uprights and operated by means of electricity. In previous issues of the REVIEW for this year will be found a description and matter concerning this then proposed plant which has been erected by the Telpherage Company at its own expense and under an agreement that in event of failure to effect a delivery of clay from the pits to trains at a siding at a rate of 150 tons per week the entire loss should be sustained by them.

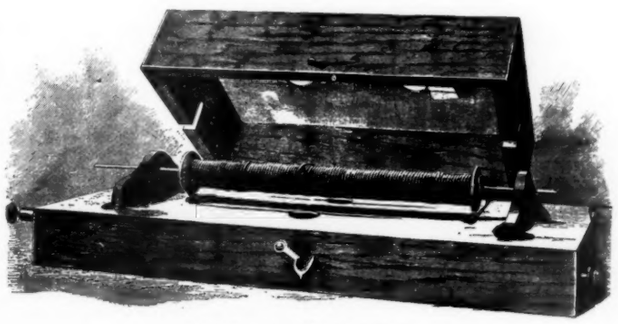
The subject of Telpherage is one of considerable importance, as it finds application not only in the transport of goods but also in the operation of dredging and land improvement. To be effective for these uses it must be so perfectly arranged as to run a number of buckets at the same time without danger of their aggregation and thus breaking the line down by excessive weight on a particular span, this aggregation being caused by the fact that the electromotive force at trains near to the charging station is greater than for trains farther away, thus causing those behind to overtake the ones preceding them. This difficulty has, according to the report, been successfully overcome by separating the buckets by span-rods so that but a certain number only can be between the uprights at once, their combined weight being insufficient to appreciably affect the span by its weight. Electrically, the resistance of the rods carrying the current is small compared with that of the motors, the electromotive force of the latter also being high proportionately to that of the dynamo supplying the current; the result is that whether the motors are near to or far away from the charging station the difference in the electromotive force of the current supplied to them is inappreciable in its effect on the speed of revolution of the axle. An extremely simple method of regulating the speed against varying mechanical resistances, such as those of ascending gradients, etc., is used wherein an automatic governor of peculiar construction is attached to the locomotive and at determined speeds of revolution either opens or closes the circuit to the motor. Thus when ascending steep grades, it closes the circuit and the current is used continually, while on descending it cuts the motor out entirely.

The prime application of Telpher lines is in its substitution in place of cart haulage; or, in fact, it is commercially applicable in all cases where the traffic is only sufficient to pay interest on a small outlay; for instance, we learn that the cost of haulage is estimated at only 15c per ton, but it is patent that if there were more trains the cost would not be so great. The Telpherage Company estimate that an electrical overhead railway carrying 100 tons daily and of the same character as the one described would cost only about $6,000, this figure including stationary engine, dynamos and five trains and that the working expense, including coal and wages of fireman and electrician and 12½ per cent. for interest and depreciation, would be less than 6c. per ton of material carried.

There is one disadvantage to this system which it shares, however, with many other practical applications of electricity and that is the high electromotive which it would be necessary to employ uninsulated for long lines and its attendant dangers, which cannot be lightly considered.

On the line at Glynde, a mile in length, the electromotive force is but 200 volts, being within reasonable limits, but where tensions of 2,000 volts with bare wires are employed, as they would have to be for long railways, the possibilities of numerous fatal accidents are strikingly apparent. In comparison with wire-rope overhead transport lines, its advantages are quite evident, the more important being that of smaller operating expenses and perfect adaptability to abrupt changes in direction.

In the various published accounts of the opening of the line, we are unable to learn that more than one train was moved between the terminal points in the same direction at once, and it is unfortunate, if this had been done, that prominence has not been given to the fact, as its omission leaves room for doubt as to the efficacy of the arrangements to overcome the electrical and mechanical difficulties mentioned above.



THE ORIGINAL REIS RECEIVER.

.... Satisfactory experiments appear to have been made in France with a new kind of telegraph wire, among the advantages of which, as claimed, is a less degree of conductivity than that in ordinary use, with a considerably higher tensile strength, thus allowing the wire to be more tightly strained, while the posts may be placed at greater distances apart. The conductivity is stated at 80 per cent., and the tensile strength varies from 34.09 to 36.82 tons per square inch. The inventor in this case has also experimented with a silicious bronze wire especially intended for telephone service, and for which tensile strength is of secondary importance. Of the modified types of this wire, one has a conductivity of 43 per cent., and a tensile strength of about 52 tons per square inch. Another type, intended for wide spans, has a conductivity of 21 per cent. and a tensile strength of some 70 to 85 tons per square inch, being thus peculiarly adapted to a numerous class of cases."

.... John R. Whitley, of London, and John G. Speed, of New York, Director-General and Secretary respectively of the American Exhibition to be held in London next year, are in Washington, D. C., to attend to some of the details of the work connected with the exhibition. Mr. Whitley had an interview with the President, to whom he made a brief report of the work accomplished by him and his colleagues. He assured the President that the work of preparation was so far advanced that the complete success of the exhibition as a thorough exposition of the arts, inventions, manufactures, products and resources of the United States was now happily beyond a doubt. The President listened with interest and expressed his entire sympathy with the objects and purposes of the exhibition, and volunteered to assist the enterprise in all ways proper and becoming. Mr. Whitley then said he had a small favor to ask, that the President should open the exhibition by telegraph on May 1 next, and by touching a button in Washington put the machinery in motion in London. The President readily assented and arrangements will be made next spring so that this may be done. Mr. Whitley sails for England in the Oregon next Saturday.

TELEGRAPHIC

....John J. Hellehin, the telegraph institute man, of Boston, was arraigned, charged with obtaining money on false pretences and held in $1,000 for further examination.

.... All arrangements have been made for laying and maintaining a line of submarine cables along the West African coast, giving us not only telegraphic communication with our West African colonies, but the much-agitated-for alternative route to the Cape.

....In the Circuit Court in Baltimore, Judge Fisher filed a motion in the case of Day *vs.* the Postal Telegraph and Cable company. The judge says that while the Postal Telegraph company of Baltimore is a corporation the receivers have a right to demand and collect debts due it by the New York company. Judge Fisher passed an order to sell all property of the Postal Telegraph and Cable company.

.... We learn that the Eastern Extension, Australasia, and China Telegraph Company (limited) has it in contemplation to lay a cable between Normanton and the Roper—in other words, along the western shore of the Gulf of Carpentaria. The distance to be thus traversed is between 400 and 500 miles. From the Roper the line is to be carried overland to Elsey Creek, some 300 miles from Port Darwin, between Daly Waters and the Katherine.

.... After a five days' conflict between the employes of the Arkansas Telegraph Company and the Iron Mountain Railroad Company the telegraph company has ceased to work on its new line to Hot Springs. The Railroad men having pulled down the poles as fast as erected by the telegraph men, an application has been made to the Chancery Court for an injunction to prevent further interference on the part of the Iron Mountain Railroad Company and other parties with the work. The court will probably hear the case Saturday or Monday. As the Circuit Court under the Arkansas Telegraph Law has already ordered the telegraph company to build a line upon the railroad company's right of way, it is believed by disinterested parties that the Chancellor will sustain the right. It is supposed that the action of the railroad company in interfering with the Arkansas Company's line is being instigated by the Western Union Telegraph Company to prevent competition.

.... The references contained in the annual report of the Baltimore & Ohio Railroad to the telegraph company are of considerable interest. The total indebtedness of the telegraph company connected with the acquisition and extension of the commercial system, contracted since 1877, is stated at $3,872,693. Bonds and stock of the telegraph company, representing the amount of such advances, are held by the railroad company. In the company's report for 1884 the expenditure on account of the telegraph company for that fiscal year was stated at $2,012,000. The comparative statistics of the telegraph system as given in the two reports are as follows:

	1885.	1884.	*Changes.*
Miles of poles.....	7,595	6,886	Inc. 649
Miles of wires.....	54,972	47,417	Inc. 7,555

Nothing is said about the earnings of the telegraph system. The whole number of the company's offices at present is 1,143, which are stated to be at points where it is believed over 75 per cent. of the entire telegraph business of the country is transacted. The hope is expressed that as all the leading cities are now reached by the system there will be a material reduction effected in its operation, and that the enterprise will finally prove a remunerative one to the railroad company. Reference is made to further extension of the lines, and the antagonism the telegraph company has encountered from the Western Union.

ELECTRICAL AND SCIENTIFIC

* * A private company is about to lay a naphtha pipe 530 miles from Baku, Russia, to Batoum.

* * The women journalists of this country have a National Press Association, and a New England branch has just been formed in Boston, of which Mrs. Sally Joy of the *Herald* is President.

* * The earth is apparently just passing the belt of the November meteors, and an unusual display of celestial fireworks is perceptible on clear nights. Most of them start from the point below the Hyades and fly southward.

* * A Japanese Court has just set an example to civilization by fining an editor twenty-seven yan for neglecting to acknowledge the source of extracts clipped from a contemporary. — *Uncredited Clippings in the Archives of Judge-Advocate Dam.*

* * The Salem Steel Wire Nail Company, of Salem, Ohio, has been incorporated with a capital stock of $100,000, and works are now being erected. The officers are Joel Sharp, president; Col. Thomas C. Boone, treasurer, and Charles S. Bonsall, secretary.

* * The megaloscope is a new apparatus lately brought to the notice of the Academie des Sciences. It is armed with an incandescent light, and is used to explore the stomach, bladder, and other cavities of the body. By its means, an objective lens may be carried into the cavity and a magnified image of its interior be obtained for the physician's inspection.

* * "The Central Electric Street Railroad," is the name of a new system proposed to be started in Washington, D. C. It will be on the same plan as those now in operation in Baltimore, New York City, Paris, and elsewhere. The cost of building a line of ten miles and running fifty cars will be $250,000, which will be one third the cost of starting a cable or horse road.

* * Jeremiah Cleveland, an uncle of the President, used to make "Cleveland clocks" in Batavia, O. James B. Wallace, of Milford, Mass., has a clock, repaired by old Jerry Cleveland, which was brought from Epping, N. H. It had been in the Norris family 150 years, and in the French and Indian war two babies were hid in its case during the Indian attack on the cabin.

* * Mr. Charles Plumb, of Buffalo, is the inventor of an electric condensing lens for microscope micro-photography. It is capable of being put at any desired angle, and is balanced upon the center of gravity and will stay in any position. It is also telescopic for raising and lowering with a four or six-candle incandesent lamp, it makes a very powerful light; it is provided with a parabolic reflector.

* * From experiments performed by Prof. Bauschinger, of Munich, it was found that of all the materials used in columns for supporting portions of buildings, cast iron and cement concrete best endured the test of great heat, as in fires and sudden cooling with water. Wrought-iron columns failed much more quickly. Brick pillars showed great resistance, but granite, limestone and sandstone were not fireproof.

* * The ten days allowed the parties in the great telephone case to file their briefs with the Secretary of the Interior expired last week. The only brief filed is that of the Washington Company, but Commissioner Montgomery has received notice from the counsel of the Globe and Bell companies stating that they will require two or three days more to prepare their briefs, and asking that this indulgence be allowed them, which will be done.

* * A collection of electrical and scientific apparatus of much value and interest has been added to the Science Cabinet of Seton Hall College, South Orange, N. J., by gift from Mr. Edward Kelly, son and partner of Eugene Kelly, of New York. It is proposed to arrange the contribution in special cases, and name it the Kelly collection.

* * Capt. J. M. Storey probably was struck by bullets oftener than any other soldier from this State. He was hit some twenty odd times. Once on picket something awful struck him. As he regained consciousness he thought it must have been a cannon ball. But it wasn't. The captain's expression was: "I never felt so good in my life when I found it was only lightning." The same thunderbolt knocked down seventeen of Capt. Storey's comrades.

* * Commencing the first of this week cars will be run on the Van Depoele Electric Railway at New Orleans, which begins at the St. Charles street entrance to the grounds and runs around the Government Building, in front of the Main Building and terminating near the avenue leading to Horticultural Hall. There will be three cars on the road run by electricity, and a fine view of the buildings and grounds can be had from the cars. Mr. J. H. Zearing has the management of the road, assisted by a full corps of employes.

* * There are certain drawbacks to the pleasure of yachting that recent inventions will tend to remove. In a sailing-boat calm weather upsets all calculations, and the odor connected with steam craft is always disagreeable, and especially to the ladies. At Millwall, near London, a trial is now being made with a small yacht, which will be propelled by electrical power. The boat is thirty-six feet in length by seven feet in breadth. It is constructed of galvanized steel, lined inside with wood and lead. The accumulators are placed below the floor of the boat, so that with the exception of a small compartment aft for the dynamos, the whole of the space is available for passengers. Two masts and a full suit of sails are also fitted for use when required. It is intended to take the yacht on a trial trip from Dover to Calais, when it is fully anticipated that a good speed will be obtained, and in such a case this new propelling power will be applied to craft of larger dimensions.

The Drawbaugh Telephone Claims Heard From Again.

Before Judge Wallace in the United States Circuit Court, in Syracuse, N. Y., a hearing was held in the case of the American Bell Telephone company *et al*, against the People's Telephone company *et al*. The plaintiffs are conducting their business with the use of the Bell telephone, patents for which were granted to Alexander Graham Bell, of Salem, Mass., in 1876 and 1877. The defendants claimed to operate with a telephone said to have been invented by Daniel Drawbaugh, of Milltown, Pa., whom they allege to have been the first inventor of the electric speaking telephone, and the suit was brought to enjoin the defendants from using and furnishing others, to use the several inventions described in Bell's patents. The issue is made and the pleadings are practically resolved into the question as to whether Patentee Bell or Daniel Drawbaugh was the first inventor.

In 1876 Bell applied for a patent and secured it. In 1879 Drawbaugh applied for a telephone patent, and after four years of preparation in the examination of witnesses, the case was argued on September 22, 1884, before Judge Wallace in New York. A short time ago he handed down a lengthy opinion to the effect that, on the evidence presented, he did not feel convinced beyond a doubt that Drawbaugh did invent the telephone before Bell. The Judge acknowledged that Drawbaugh had the instruments presented in court, and that they were known to hundreds of his neighbors, who were witnesses before the court. The instruments were called "talking machines," and were electrical instruments. The Judge does not question the integrity of this "cloud of witnesses," as he terms them, but thought that the evidence should be complete in every respect, and as there was still doubt in his mind as to the date of the invention by Drawbaugh, he was forced to decide that the Bell patent must stand on the evidence as then before him.

This hearing is under stipulations between the Bell and Drawbaugh contestants to reopen the case tried in New York and introduce new evidence taken by the defendants and cross examined by the plaintiffs since the New York trial. This evidence, it was claimed by the Drawbaugh counsel before Judge Wallace, was taken to meet and overcome the doubts expressed by the Judge in his New York decision on certain points which he treated of in his opinion. This was the line of argument by Judge Hill of Chicago, and his associates, P. C. Chandler and Henry C. Andrews, and it was opposed by the Bell counsel, Messrs. J. J. Storrow, of Boston, and E. A. Dickerson.

Street Light Committee of San Francisco.

The Committee on Street Lights of the Board of Supervisors of San Francisco, met recently and transacted the following business:

Numerous petitions were presented from electric companies asking for franchises to lay wires. The Pacific Coast Electrical Construction Company, in a petition, asked to be allowed to erect poles and wires. The representative of the company stated that all the work connected with the erection would be done in this city. The San Francisco Conduit and Electric Light Company was represented by Mr. McGrew, who proposed to lay wires underground. The petition of the Pacific Thompson-Houston Electric Light and Power Company was also considered.

Mr. Farnsworth stated that action in these matters had been delayed to await the investigations of Mr. Ladd who had gone east to examine plans for laying wires.

Clerk Russell informed the committee that three franchises had already been granted to electric light companies.

Mr. McGrew said that if he was allowed to run his wires he would guarantee that they would not interfere with telephone or telegraph wires. He would begin work within three months as required by the city ordinance.

Mr. Russell then read to the committee the opinion of Alexander Bell, of the Bell Telephone Company, to the effect that all wires should be placed underground.

Further proceedings of the committee were practically stopped by the Clerk informing them that they had no more money, as the Urgent Necessity Fund was overdrawn to the extent of $1,600. The regular expenses out of this fund is $2,400 per month which leaves a margin of $600, which, it seems, is not enough to accommodate the Poundkeeper.

It was recommended that a mast and electric light be erected at Fifteenth avenue and San Bruno road.

The property owners in the vicinity of Twenty-fifth and Castro streets were promised an electric light as soon as there was any money to do it with.

The committee then adjourned for two weeks.

When the construction of the great trunk subterranean telegraph lines in France and Germany was entered upon, it was thought that, owing to their depth under ground and their sheathing of metal in contact with the earth, they would be exempt from the influence of atmospheric disturbances. M. Blavier, the well-known electrician, has nevertheless, pointed out recently to the French Academy of Sciences, that in time of storm currents are produced in these lines which discharge themselves through the lightning protectors, melting their fine wires. They are, however, less violent than the currents in aerial wires, and do not appear to interfere with the traffic.

The Brooklyn Bridge a Magnet.

Tests made of the elevated railroad structures, of the Brooklyn Bridge cables, and iron store fronts show that they are all magnetized. The induced magnetism from the earth is supposed to have been fixed by the jarring to which these structures have been subjected while under magnetic influence. The bottom parts of all pieces of iron thus magnetized show north polarity, and the cables of the bridge are said to be magnetized in the direction of their diameter, the upper surface of the cables, throughout their length, being of south polarity and lower surface north.

"It has long been known," said a scientist, "that iron when subjected to repeated blows, while under the influence of a magnet, attains permanent magnetic qualities. Soft iron of pure quality is affected very little in this way, though impure wrought and cast irons are capable of being permanently magnetized. As early as 1600 Gilbert experimented in this direction by placing bars of iron in the magnetic meridian and striking them with a hammer. It would require very little imagination, therefore, to suppose that, in a busy city containing iron structures of all kinds, the latter should possess magnetic qualities. Such, indeed, is the case, and I'll give you here the results of a few experiments, made with the view of determining their character and extent. The instrument used in these trials consisted of a surveyor's compass, the needle being about four inches long and delicately mounted, so that even very slight indications of magnetism were observed by it.

"The first object investigated was the structure of the elevated railroads. You know that they consist essentially of wrought-iron posts, or columns, which support trusses or open beams, upon which the tracks are laid. Beginning with the posts, an examination of a large number of them showed that, with very few exceptions, they possessed magnetism. The examination extended in various directions in the city, and posts distant seven miles from one another showed the same magnetism. The cast-iron columns which support the roofs of the stations showed the property to a remarkable degree, as did likewise a stove in the waiting-room of the station.

"My attention was next occupied by the Brooklyn Bridge. Entering at the New York side, a few minutes' walk brought us to the cables on either side of the promenade. Selecting the most convenient parts of the cables, namely, the tops, or upper sides, and testing them, magnetism was shown in both of them. Careful observation showed that the points of greatest intensity lay opposite to each other in the line of the magnetic dip, about 76° in this locality. The rest of the iron work on the bridge showed the same properties as that of the elevated railroads, and a further confirmation of this peculiarity was established by an examination of the rails in the yard of the Grand Central Depot, where they are subject to frequent shocks of heavy locomotives. These rails are of steel, and show the greatest irregularities as regards magnetic qualities, of which all are possessed more or less. Thus, for instance, some were found to be magnetized lengthwise; others, again, like the bridge cables, according to their breadth. In the latter case, the top of the rail would invariably attract the north end of the needle, while the bottom attracted the south pole. The distance between these two positions being only four inches, shows how marked the indications were, as the needle was complacently swung around through an angle of 180°. The effect took place especially in the vicinity of switches, where connecting rods joined both rails. All rails free from contact, such as guard rails, were found to possess magnetism at their ends only. The examination extended also to iron buildings and miscellaneous iron work in the city. Several buildings with cast-iron fronts were examined, and showed that they were magnetized. Again, a beam in one of the warehouse buildings under the arches of the Brooklyn Bridge was magnetized in the direction of its breadth. The Grand Central Depot consists of iron arches whose extremities at the ground are magnetized. The lamp posts about town showed marked magnetic properties, as did also the hydrants. In buildings heated by steam the radiators were found to be magnetized.

"Instances could be multiplied," concluded the scientist, "but these I have mentioned will suffice to show that it would be well nigh impossible to procure a piece of iron entirely free from magnetism. The explanation of all these phenomena is very simple, when we consider that the earth is a great magnet, the south pole of which is our hemisphere."

—— The Ball Electric Light Company have just installed a 25-light plant (arc) in the extensive print works of S. H. Greene & Sons, River Point, R. I. So well satisfied are they with the Ball system, and the economy with which it can be run, they will increase their plant to 100 lights immediately.

—— When the night foreman went to his electric-light works, at St. Joseph, Mo., he found Jas. W. Prashka, the engineer, lying beside the dynamo in an insensible condition. There was no one present at the time of the accident, but the supposition is that he attempted to take hold of the brushes on the dynamo with both hands, forming an electric circuit which prostrated him. The physicians say there is no possibility for his recovery.

—— An electric-light gentleman sends us the following, which carries its own moral: "To show how men will fool with things which they know nothing about, I will give you an incident which occurred here on the first evening I lighted up. I was standing by the machine, after seeing that all the lights were in order, when a snap at the brushes warned me that one of the 'safety fusible cut-outs' had melted. After regulating the brushes I went to look for the trouble and found that the lamps on a 12-light branch circuit were extinguished, while all the other lights were in order. Examination showed that the fusible wire had melted, and upon putting in a pair of reverse plugs the lamps burned all right. I then learned that one of the workmen had invited the *foreman* of the shop take a shock, and showed him how to do it by taking two pieces of bare iron wire, one in each hand, and holding them to the two main wires. Of course this did no harm either to him or the lamps, and the foreman then took a piece of iron wire and touched the two ends of it to the terminals of the two mains on this 12-light branch. Of course he short-circuited the whole current, and thus caused the cut-outs to melt. It is fortunate for him that his first experience of this kind was made on this incandescent system, as, had he tried it on an arc light circuit, there would have been another fool killed. He was badly scared, but not in the least hurt. The current here is only of 94 volts tension.

—— At many theaters, both in London and the provinces, the electric light has been successfully used as an accessory to stage effect. It is not long since we described the very interesting and ingenious installation of arc lamps at Her Majesty's, and we have now to offer our congratulations to Mr. Edgar Bruce, of the Prince's, upon the manner in which he has availed himself of the facilities offered by the incandescent light. Thanks to this gentle illuminant, the theater over which Mr. Bruce so ably presides is one of the pleasantest in London. Its auditorium is cool, excellently lit, and entirely free from the oppressive odor which results from the combustion of gas. Not only is the installation carried to every part of the building, but great care, attention and taste have evidently been bestowed upon its arrangement. On the stalls level are the refreshment kiosk and smoking fernery, in which latter the incandescent lamps, half hidden amongst foliage or peeping out from curious little recesses, are most artistically grouped. In the kiosk there are but 12 lamps, in pairs; and in the fernery six only, but on the occasion of our visit they were working up to their full power and gave ample light. Theatrical criticism being somewhat out of our province, we must refrain from a commentary upon the merits of the "Great Pink Pearl" other than to say that it is very very funny. In the last act, however, a fine effect is introduced by the instantaneous illumination of the interior of the Russian Embassy in Paris by incandescent lamps. An ordinary switch placed near the doorway, and actuated by an attendant in obedience to a simple request for "lights," transforms the stage from almost total darkness to a sudden blaze of light, and produces a powerful impression upon the audience. The whole of the lamps are run from accumulators.—*London Electrician.*

A New Galvanometer and Rheostat.

The Western Electric Company have just brought out a new style of galvanometer, which we illustrate herewith.

The set consists of a detector galvanometer and a Wheatstone bridge, in a case in convenient portable form.

The rheostat consists of three rows of ten coils each, the first row being coils of one ohm each designated "units;" the second of ten ohms each, designated "tens;" and the third of one hundred ohms each, designated "hundreds." The total resistance is, therefore, 1,110 ohms. The two arms of the bridge consist each of two coils—one of ten ohms and the other of one hundred ohms—so that the capacity of measurement of the apparatus is one-tenth of an ohm to 11,100 ohms.

The arrangement of the coils is such that one plug only is used to each row, thus avoiding the multiplicity of bad connections on account of ill-fitting plugs, and making the reading as simple as possible.

If, for instance, in balancing the bridge, it is required to put the plug of the "hundreds" row into "7," of "tens" row into "5," and of "units" row into "3," instead of adding up the coils, one reads direct 753 ohms.

COMBINATION RHEOSTAT AND GALVANOMETER OF THE WESTERN ELECTRIC COMPANY.

—— The right of the city of Philadelphia to sell the gas works has been affirmed in an elaborate opinion given by Attorney John G. Johnson, in which he says: "Of course the gas loanholders have no need for a sinking fund, and the city would be more than glad to pay to such of them as think otherwise the full amount of their 6 per cent. bonds, but they are entitled to demand every collateral, however unnecessary, which is provided for them by the contract. I see no restriction, however, upon an absolute and uncontrollable power of sale by the city. An absolute right to take possession of the works is conferred upon it. This possession it may part with to lessees or purchasers. It will be necessary in making such sale or lease to specifically provide a fund equal to eight per centum per annum and State taxes upon the amount of the loans issued under said ordinance, to be paid to the City Treasurer and to the Sinking Fund Commissioners, and to be applied in the manner therein indicated. To such specific payment and application the bondholders are entitled."

—— The F. F. Adams Manufacturing Company, of Erie, Pa., will put a dynamo in their works to furnish 16 lights of 2,000 candle-power each. An order was given to Chicago parties who will furnish the apparatus. The Ball Engine Company will establish the plant, and it is expected to have the lights in operation not later than a week hence. The supply of natural gas, with which the works have been lighted hereto fore, is proving insufficient.

—— The prices paid by cities in the United States for electric lights to illuminate their streets are as follows: Boston pays sixty-five cents per night per lamp; New York pays seventy cents per night per lamp; Philadelphia pays sixty cents per night per lamp; Baltimore pays sixty-five cents per night per lamp; Rochester pays forty five cents per night per lamp; Buffalo pays fifty-five cents per night per lamp; Cleveland pays six cents per hour; Detroit pays $90,000 a year for 400 lights; Minneapolis pays $200 per lamp per year; New Orleans pays $200 per lamp per year.

—— Says a recent buyer of machinery: "To see a manufacturer's announcement of his goods in the advertising columns of reputable trade journals always inspires confidence in the mind of the buyer. It looks as though he had faith in himself and his manufactures and challenged the world to an examination. In these days of progress when a man has a good thing to sell, he is usually anxious that the public should be fully informed concerning it.—*Manufacturers' Gazette.*

—— At Lafayette, Ind., the Western Union Telegraph Company has filed an injunction suit against the Electric Light Company, asking an order to restrain that company from using the poles of the Western Union on Second street, and from placing wires under or across those of the plaintiff. The trouble arises from the defendant using for a time the poles of the Western Union in running the electric light down to the Car Works. The Electric Light Company is taking the matter coolly and will probably contest the matter, which will soon have a hearing.

ELECTRIC LIGHT NEWS

—— Not only the star of empire but later means of illumination tend westward. The town of Butte, Mon., now rejoices in the electric light.

—— The Electric Light Companies have now got to a point where they will soon begin to yield dividends—the parent companies may pay big ones and the sub-companies can be counted on for good ones.—*Investors' Guide.*

—— Mr. John Crawford has just completed the work of putting in an incandescent plant in Mr. Tollner's factory at Pulaska, N. Y. The work was done in a very satisfactory manner, and Mr. Tollner is now talking of enlarging the plant.

—— The Godfrey Seamless Pocket Company, of Plymouth, Mass., have just put in a 25-light plant (arc) of the Ball system, and are so well pleased with it they are making calculations to increase it to 75 lights, and furnish the stores and streets with light.

—— Judge Peckham has issued a decree setting aside the contract with the Electric Light Company for lighting the streets of Albany. The Chamberlain is restrained from paying to the company any money under the contract. The decree contains forty-three findings.

—— The lighting of the Buda-Pesth Exhibition has, with the exception of a few Egger lamps, been entirely carried out by Ganz & Co., of Buda-Pesth. The installation includes about 116 arc and 1,200 incandescent lamps, and about ten slow-speed dynamos, driven principally, by a 70 horse-power steam engine.

—— The era of electric lighting is responsible for a prefix to the names of a good many articles. We have electric-light engines, electric-light belts, electric-light oil, and various other electric-light articles. It is probable if these are good enough to be used in electric-light plants, they may answer for other purposes where the conditions are not too exacting.—*American Machinist.*

—— The Common Council Committee on Lamps, of Buffalo, met at the City Clerk's office recently. Several taxpayers appeared and argued in favor of having the electric light on the Williamsville road, between Broadway and Seneca streets. The committee will report in favor of lighting the road as requested after Jan. 1, 1886. The committee also will report in favor of extending the lamp district in Baynes Street, between Auburn and Bouck Avenues, and of laying gas mains in Boston Alley and providing lamps.

—— An electric-light company has been organized in Topeka, Kan., for the purpose of establishing the incandescent light in that city and State. The following directors have been appointed for the first year: A. S. Johnson, J. F. Goddard, J. R. Mulvane, J. P. Griswold, B. M. Davies, John R. Price, P. G. Noel, G. F. Parmelee, E. Wilder. The amount of the capital stock has been fixed at $200,000, divided into 2,000 shares of $100 each.

—— The committee on streets held a meeting at Lawrence, Mass., last week, to consider the petition of nearly 600 residents of South Lawrence to have the city government retain electric lights on the bridges and railroad crossings between Lawrence and South Lawrence. All present were unanimous in retaining the lights. After the hearing the committee voted unanimously to recommend to the city government that the proposition of the Lawrence Electric Light Company to furnish lights for bridges, the Common and public streets at the rate of $10 per month be accepted. About 20 electric lights are now in use.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING NOV. 24, 1885.

330,368 Telephone system; Robert P. Barbier, Paris, France.
330,433 Armature core for dynamo-electric machines; Marmaduke M. M. Slattery, New York, N. Y. assignor by direct and mesne assignments to the Sun Electric and Illuminating Company, Manchester, N. H.
330,449 Rheostat; Edwd. Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.
330,450 Electric lamp; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.
330,451 Electrical meter; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.
330,463 Electro-magnet; Harold P. Brown, Chicago, Ill.
330,464 Incandescent electric lighting; Harold P. Brown, Chicago, Ill.
330,465 System of electric lighting; Harold P. Brown, Chicago, Ill.
330,466 Device for making and breaking electric circuits; Harold P. Brown, Chicago, Ill.
330,486 Lightning arrester; Arthur J. Holt, Cleveland, Ohio.
330,490 Armature for dynamo-electric machines; C. D. Jenney, Indianapolis, Ind.
330,586 Incandescent electric lamp; Chas. Heisler, St. Louis, Mo.
330,605 Electric railway; James F. McLaughlin, Philadelphia, Pa., assignor by mesne assignment to the National Electric Railway System, same place.
330,632 Contact-maker for electric clocks; Louis H. Spellier, Philadelphia, Pa.
330,635 Telegraph sounder; George W. Stewart, New York, N. Y., assignor of one-half to Stephen J. Cox, same place.
330,644 Electric switchboard; Theodore N. Vail, Boston, Mass., assignor to the American Bell Telephone Company, same place.
330,763 Telephonic circuit and apparatus; John B. Wood, Montreal, Quebec, Canada.
330,836 Dynamo-electric machine; Oscar F Jonsson, Stockholm, Sweden.
330,873 Insulating tube for electric wires; Henry B. Cobb, Wilmington, Del
330,874 Insulating tube for electric wires; Sam. B. Cobb, Chicago, Ill., assignor to Henry B. Cobb, Wilmington, Del.
330,879 Telephone transmitter; Julius Emmner, Jr., Washington, D. C.
330,903 Combined annunciator and alarm; Frank E. Kinsman, New York, N. Y.
330,923 Clock synchronizer; Alfred Ramel and Wm. W. Dean, St. Louis, Mo., assignor of one-half to Paul Bakewell, same place.
330,938 Primary electric clock; Wm. L. Stevens, Dorchester, and Edwin J. Westcott, Hyde Park, Mass.
330,949 Electric switch or circuit controller; Merle J. Wightman, Hartford, Conn.
331,002 Clamping device for incandescent electric lamps; Chas. G. Perkins, New York, N. Y., assignor to the Imperial Electric Light Company, same place.
331,042 Electric signal for railroad cars; John R. Demier, Chester, Ill.
331,091 Fire escape; Horace F. Neumeyer, Macungie, Pa.
331,121 Electric apparatus for dental operations; Charles A. Eisenhart, York, Pa.
331,148 Automatic circuit closer for telegraph instruments; James W. Mc. Arthur, Walton, Kas.
331,155 Armature for dynamo-electric machines and motors; Benjamin F. Orton, East Saginaw, Mich.
331,186 Telephone exchange system; Joseph P. Davis, New York, N. Y.
331,221 Means for turning on and shutting off gas by electricity; Le Roy S. White, Waterbury, Conn., assignor to the Electrical Appliance Manufacturing Company, same place.
331,250 Telegraphic repeater; Willard M. Miner, Thurlow, Pa.
331,257 Automatic electric annunciator; Charles W. Price, New York, N. Y., and Albert Barrett, Kansas City, Mo.

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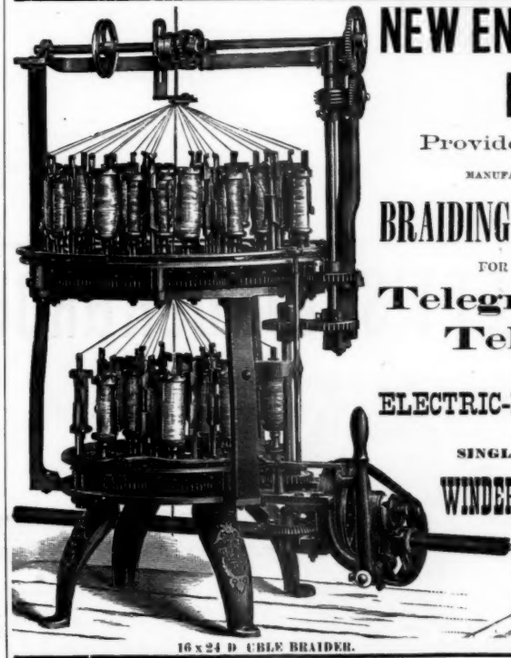

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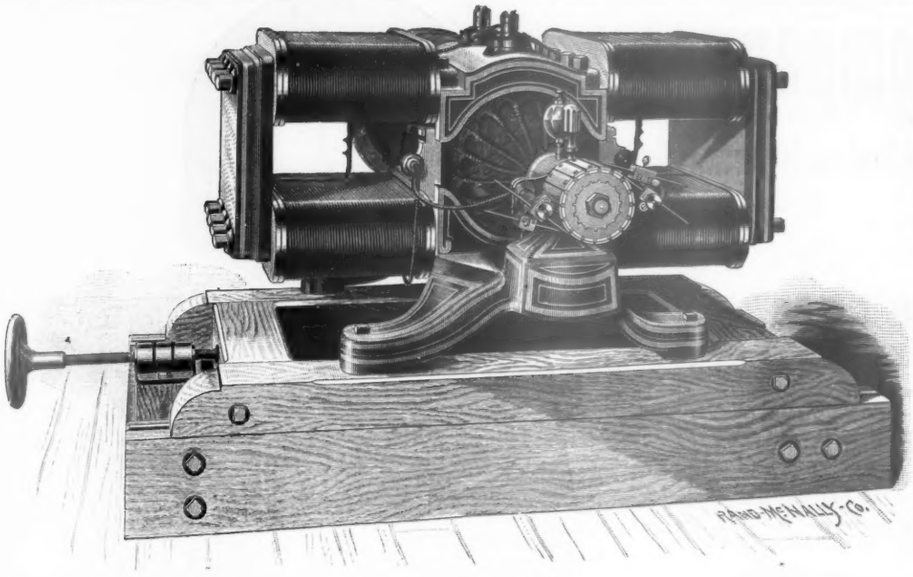

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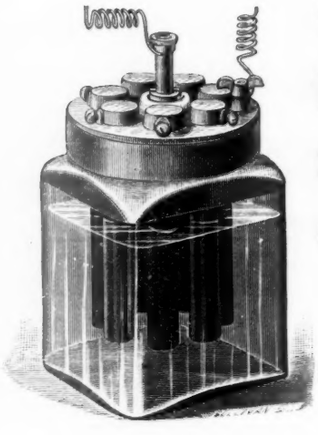

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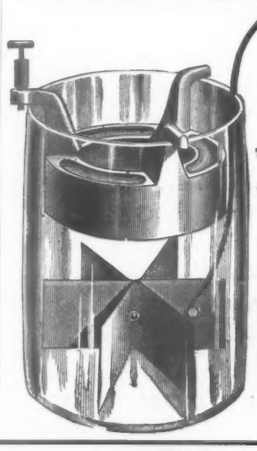

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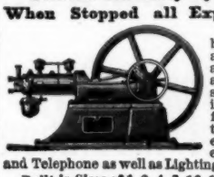

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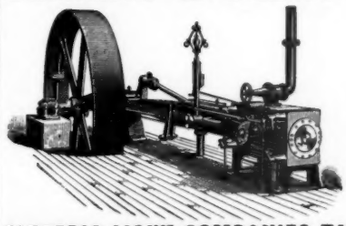

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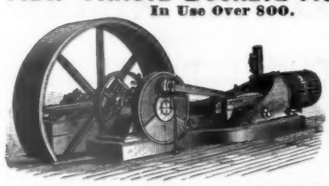

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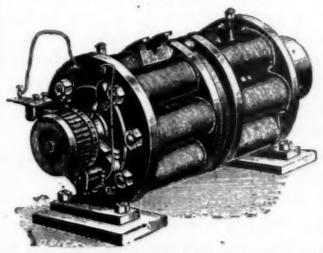

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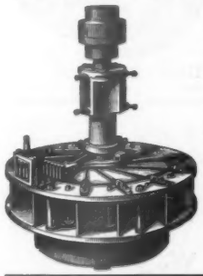

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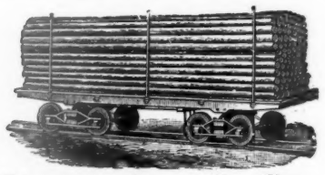

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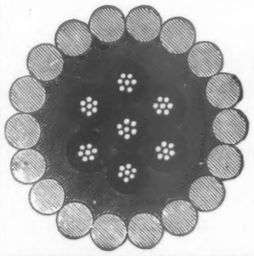

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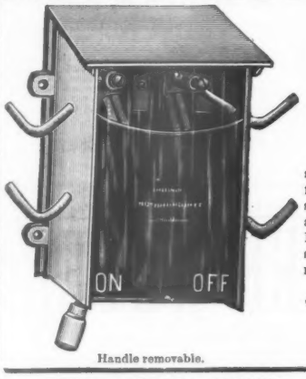

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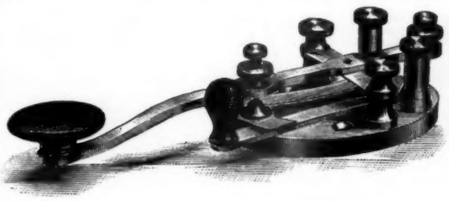

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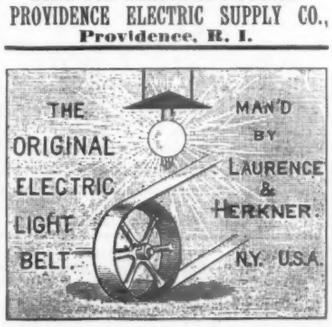

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